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ALIEN PROPERTY CUSTODIAN

ELECTRIC WIRES AND METHOD FOR MAKING THE SAME

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It is already known to make electric wires comprising a conducting core, a refractory insulation and an external metallic sheath or sheathing, such wires being intended for various uses.

In such type of wires the external sheath was heretofore formed with the same metal as the core, i. e. with copper. As a result, among other disadvantages, the weight of the wires was relatively high.

The present invention has for its object a new electric wire provided with an external sheath of aluminium or other light metal.

The tests which were carried on ended in a surprising result showing that it is indeed possible to draw or roll a work-piece comprising a copper core, a refractory insulation such as magnesia and an aluminium sheath, under satisfactory conditions, i. e. in securing through this treatment an identical lengthening of the core, of the insulating layer and of the sheath. Very good results are obtained in using aluminium in a very pure condition particularly with an aluminium content higher than 98% and preferably near to 99,5%.

Aluminium might also be substituted by a light metal of equivalent ductility, such as magnesium.

It has further been ascertained that the selection of aluminium enables to use relatively low temperature zones for annealing, at which the metal is practically unoxidisable, a feature which enables to proceed directly with drawing after annealing and particularly without intermediate pickling. Finally corrosion due to chemical agents is extremely weak and lighter electric wires are obtained.

It might also be advantageous to use for the core of said wires a metal whose features are different from those of the sheath. Should aluminium in the above mentioned pure condition be used for the sheath, it might be advantageous to use aluminium of a different degree of purity for the core in order to secure other features, particularly a greater hardness or a higher or lower resistivity; for instance, either resisting wires for transforming energy into heat may be used for the core or on the contrary very highly conducting wires such as red copper wires.

During the metallurgical treatments the difficulty evidently resides in annealing simultaneously the different metals forming the core and the sheath, in order to overcome the hardening due to drawing, and particularly to anneal the core at higher temperatures than the sheathing in order to meet the conditions of the cycle of temperatures most convenient for each of them.

The following method enables to overcome the said difficulty. It consists in heating the core and the sheath up to different annealing temperatures by feeding the core with a heating current of convenient intensity with or without external heating of the wire.

The wire may for instance be subjected to annealing by using an external source of heat. By taking the due steps, the temperature will rapidly be equalized between the core and the sheath owing to the high thermal conductivity of the compressed insulation.

The temperature of the core is then raised of the proper additional amount by supplying it with an electric current whose value is so chosen that the equilibrium of the temperatures of the core and of the sheath will be reached in such conditions that each of the elements forming the work-piece will be exactly brought at its most convenient temperature.

The practice has shown that, in this way, it will be possible to obtain wires of new features and having besides the properties already secured by other processes (such as absolute tightness, high insulating resistances and perfect incombustibility, a high mechanical resistances and which are perfectly unalterable) a conductibility referred to the weight per linear foot which is higher than the value heretofore obtained and a remarkable flexibility in order to enable the wire to follow the outline of the objects over which it is arranged.

Thus a wire with a core constituted by a red copper conductor of 16/10 with about 1.5 millimeter thickness of insulation and an aluminium external sheath of about 0.75 millimeter thickness will only have a weight of 75 gr. per meter, although its kilometric resistance is only of about 8.2 ohms.

The invention comprises, as new industrial products, the work-pieces formed by a highly pure aluminium tube-sheath whose aluminium content is higher than 93 per cent and preferably selected between 99,5 and 100 per cent, the work-pieces constituted as described above and in which the core is further either made of the same aluminium as the sheath or of different aluminium or of a metal of higher mechanical strength or of higher or lower resistivity, particularly red copper.

As a finished product, the invention comprises the wires obtained with work-pieces which are particularly constituted as follows: by an external sheath of aluminium whose aluminium con-

tent is higher than 98 per cent and preferably comprised between 99,5 and 100 per cent; by a dielectric material formed by a pulverulent refractory insulation under a high state of compactness, and which is homogeneous and isotropic; by a core of same metal as the sheath or of a different metal, either of aluminium of different content or of another metal of higher mechanical resistance, or other metal of higher resistivity, or of minimum resistivity, particularly red copper, the weight of said wire per mho-km being indeed lower than the weight of the same type of wires heretofore obtained.

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ALIEN PROPERTY CUSTODIAN

MEDICAMENTS AND PROCESS FOR THE MANUFACTURE THEREOF

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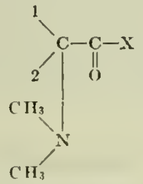
This invention relates to a process for the manufacture of agents acting as local anaesthetics and on the blood pressure.

Ephedrine and its hitherto known derivatives possess, apart from their action of increasing the blood pressure, no therapeutically utilisable action as local anaesthetics.

It has now been found in accordance with the present invention, that by modifying the ephedrine molecule substances having a therapeutically utilisable action as local anaesthetics are obtained without at the same time losing the action of increasing the blood pressure.

In accordance with the invention the originating materials treated are bodies of the following constitution:



in which 1 and 2 are alkyl or hydrogen and X aryl, amino or oxyalkyl. The aforesaid substances are subjected in accordance with the invention to the Grignard reaction, namely with aryl Grignard solutions. The originating products are thereby converted into substances which contain, in addition to a tertiary OH group, a double aryl group attached to the carbonyl-carbon atom.

A particularly good yield of the desired agents having the action of local anaesthetics and of increasing the blood pressure is obtained if the Grignard reaction be not carried out as generally usual with equimolecular quantities of Grignard reagent, but if an excess of the Grignard compound be present in the conversion. In general good yields are obtained by employing two molecules of the Grignard reagent, for example when subjecting an amino-ketone to the Grignard reaction, and by employing three molecules of the Grignard reagent when subjecting an amino-acid ester to the Grignard reaction.

The following embodiments of the process given by way of example describe the subjection to the Grignard reaction of a ketone in which the X corresponds to an aryl group, and the subjection to the Grignard reaction of an ester in which in the foregoing formula the X corresponds to an oxyalkyl group.

Example I

A Grignard solution is prepared in known manner from 6.4 magnesium, 40 grams benzene bromide and 100 ccm. absolute ether and 20 grams of dimethylamino-acetophenone, dissolved in 50 ccm. of absolute ether, are added drop by drop thereto. The reaction, which takes place violently at first, is concluded by heating for from 1 to 2 hours on the water bath. The reaction product is poured onto ice and treated with concentrated hydrochloric acid until it is acid to Congo Red. The hydrochloride of diphenyldimethylamino-methylcarbinol precipitated in this process is purified either by recrystallisation from water or by dissolving in and precipitating with acetone from methyl alcohol. The yield amounts to from 70% to 80% of theory.

Properties

The hydrochloride is obtained in the form of white plates by precipitation from alcohol with ether. It is readily soluble in water and alcohol, fairly sparingly soluble in acetone and insoluble in ether. Melting point=230–232° C. with decomposition. The base, after recrystallisation from 50% alcohol, has a melting point of 55° C. It is readily soluble in alcohol, ether, benzene, chloroform, petroleum ether and insoluble in water.

Example II

A mixture of 15 grams of dimethylglycine ester and 100 ccm. of absolute ether is added drop by drop to a Grignard solution of 9.6 grams of magnesium, 60 grams of benzene bromide and 200 ccm. of absolute ether. The reaction which proceeds with sputtering and boiling, is kept within moderate limits by cooling. The product is worked up in the manner set forth in Example I.

When using the dimethylamino acid amides as originating materials the process can best be carried out in two stages. By treating the dimethylamino acid amides with arylmagnesium halides the former are first converted into aromatic aminoketones, which are then converted in turn into the corresponding amino-alcohols by further treatment with arylmagnesium halides.

Example III

A solution of 20 grams of dimethyl-amino-acetic acid dimethylamide in 50 ccm. of absolute ether is added drop by drop to a Grignard solution of 72.5 grams of benzene bromide, 11.2 grams of magnesium and 200 ccm. of absolute ether. By heating for two hours on the water bath the

reaction is completed and the reaction product is treated with ice and hydrochloric acid. The base precipitated with ammonia is dissolved in ether, dried with calcium chloride and distilled in vacuo. A yield of approximately 80% of pure dimethylaminoacetophenone is obtained. The aminoketone thus obtained is converted into diphenyldimethylaminomethylcarbinol in the manner set forth in Example I.

Example IV

Dimethylaminoacetophenone from dimethylaminodiethylacetamide

A Grignard solution is prepared from 150 grams of brom-benzene, 23 grams mg and 400 ccm. of absolute ether and to it are added 60 grams of dimethylaminodiethylacetamide in 200 ccm. of ether. After heating for one hour on the water bath the product of reaction is treated with ice and hydrochloric acid, the base precipitated with ammonia, dissolved in ether and distilled in vacuo after the removal of the ether. Yield 46 grams of dimethylaminoacetophenone=74% of theory.

Example V

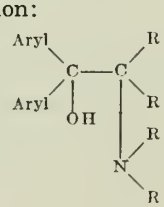
Dimethylaminomethyl-1.3-dimethylphenylketone

40 grams of dimethylaminodimethylacetamide in 150 ccm. of absolute ether are added to a Grignard solution made from 150 grams of 1.3-dimethyl-4-brom-benzene, 20 grams of magnesium and 400 ccm. of absolute ether. The reaction is completed by heating for from 2 to 3 hours on the water bath. The dimethylamino-1.3-dimethylphenylketone precipitated with the aid of ammonia from the reaction product treated with ice and hydrochloric acid, is dissolved in ether and after drying with potash is distilled in vacuo. Boiling point (11–13 mms. Hg) =144–146° C. The yield amounts to from 60% to 65% of theory.

Example VI

α-dimethylaminopropiophenone

A Grignard solution of 80 grams of brom-benzene, 12.4 grams of magnesium and 200 ccm. of absolute ether is made to react with a solution of 30 grams of α-dimethylaminodimethylpropionamide in 100 ccm. of absolute ether. The reaction product obtained after heating for two hours on the water bath yields after treatment with ice and hydrochloric acid and precipitation with ammonia 26 grams of α-dimethylaminopropiophenone=70% of theory. The compounds described in the foregoing become of particular therapeutical value when they possess the following constitution:



wherein R is H or alkyl and one or both aryl groups contain at least 8 carbon atoms. These substances however, possess no action on the blood pressure or practically no such action, while their surface anaesthetic and bactericidal properties are increased many times. It is surprising and completely unexpected that despite the increase in the bactericidal power the toxicity towards warm-blooded animals is considerably smaller.

Compounds of this kind are obtained by causing the corresponding arylmagnesium compounds to react with amino-acid esters or aryl-aminoalkylketones in the manner similar to that described in the foregoing.

Example VII

Bis-(1.4-dimethylphenyl)-dimethylaminomethylcarbinol

A Grignard solution is prepared in the customary manner from 130 grams 2-brom-p-xylene, 17 grams magnesium and 300 ccm. absolute ether and to this solution 30 grams of ethyl dimethylamino acetate in 50 ccm. of ether are added gradually with stirring. The reaction is completed by heating for several hours under reflux, and the reaction product is treated with a little ice and hydrochloric acid. After standing for several hours the bis-(1.4-dimethylphenyl)-dimethylaminomethylcarbinol hydrochloride crystallises quantitatively from the concentrated magnesium chloride lye and is purified by recrystallisation from water.

Example VIII

Bis-(1.3-dimethylphenyl)-dimethylaminomethylcarbinol

A solution of 30 grams dimethylglycine ester in 50 ccm. ether is added drop by drop to a Grignard solution of 90 grams 1.3-dimethyl from benzene, 11.5 grams magnesium and 250 ccm. ether, and the mixture is heated for several more hours under reflux until the reaction is completed. The solution is treated with ice and hydrochloric acid and worked up in a similar manner to that set forth in Example VII.

Example IX

Bis-(1.2-dimethylphenyl)-dimethylaminomethylcarbinol

30 grams dimethylamino-ethyl acetate in 50 ccm. absolute ether are dropped while shaking into a Grignard solution of 120 grams 1.2-dimethyl-4-brom-xylene, 15.5 grams magnesium and 300 ccm. absolute ether. After heating for from two to three hours under reflux the reaction product is poured on to ice and the basic magnesium bromide precipitated is treated with hydrochloric acid. The crude hydrochloride of bis-(1.2 - dimethylphenyl) -dimethylaminomethylcarbinol precipitated is converted into the base with the aid of ammonia, dissolved in ether and the pure hydrochloride is precipitated with etheral hydrochloric acid.

Example X

Bis-(1.4-dimethylphenyl)-dimethylaminomethylcarbinol

There are added 20 grams 1.4-dimethylphenyldimethylaminomethylketone in 50 ccm. of absolute ether to a Grignard solution of 50 grams 2-brom-p-xylene, 6.5 grams magnesium and 200 ccm. absolute ether. After the mixture has been heated under reflux for several more hours for the completion of the reaction, the reaction product is worked up as described above.

Example XI

Phenyl-1.4-dimethylphenyl-dimethylamino-methylcarbinol

A solution of 20 grams dimethylaminoacetophenone in 50 ccm. ether is added in similar manner to a Grignard solution of 50 grams 2-brom-p-xylene, 6.5 grams magnesium and 200 ccm. absolute ether. After pouring the reaction product into ice and treating with hydrochloric acid, an etheral solution of phenyl-1.4-dimethylphenyl-dimethylaminomethylcarbinol is obtained by thc addition of ammonia and shaking up with ether. The hydrochloride of this compound is obtained by precipitation with etheral hydrochloric acid and thereupon recrystallising.

Another method of preparing dialkylaminoalkyl aryl ketones, which are intermediate products in the preparation of the medicaments of the present invention, is to cause aryl magnesium halides to react with dialkylamino-acid amides. The most convenient method of working is to use from 2 to 2½ moles of the aryl-magnesium compound to 1 mole of the dialkyl-acid amide.

Example XII

Diethylaminoacetophenone

37 grams of diethylaminodicthylacetamide in 100 ccm. of absolute ether are added gradually to a Grignard solution prepared from 80 grams of brom-benzene, 12.4 grams of magnesium and 200 ccm. of absolute ether. The reaction product is boiled for 1 hour under the reflux condenser for the completion of the reaction, poured on to ice after cooling, and the precipitated basic magnesium bromide is dissolved in hydrochloric acid. The oily, yellow-tinged diethylaminoacetophenone precipitated by treatment with ammonia is dissolved in ether, dried with potash and distilled in vacuo after removal of the ether. The yield amounts to 29 grams of diethylamino-acetophenone=76% of theory.

Example XIII

Dimethylaminoacetophenone from dimethyl-aminodiethylacetamide

A Grignard solution is prepared from 150 grams of brom-benzene, 23 grams mg and 400 ccm. of absolute ether and to same 60 grams of dimethylaminodiethylacetamide in 200 ccm. of ether are added. After heating for one hour on the water bath the reaction product is treated with ice and hydrochloric acid, the base is precipitated with ammonia dissolved in ether and distilled in vacuo after removal of the ether. Yield: 46 grams of dimethylaminoacetophenone=74% of theory.

Example XIV

Dimethylaminomethyl-1.3-dimethyl-phenylketone

40 grams of dimethylaminodimethylacetamide in 150 ccm. of absolute ether are added to a Grignard solution prepared from 150 grams of 1.3-dimethyl-4-brom-benzene, 20 grams of magnesium and 400 ccm. of absolute ether. The reaction is completed by heating for from two to three hours on the water bath. The product of reaction is treated with ice and hydrochloric acid, the dimethylamino-1.3-dimethyl-phenyl-ketone is separated from same with the aid of ammonia, dissolved in ether and after drying with potash is distilled in vacuo. Boiling point 144–146° C. (11–13 mms. Hg). The yield amounts to from 60% to 65% of theory.

Example XV

α-dimethylaminopropiophenone

A Grignard solution of 80 grams of from benzene, 12.4 grams of magnesium and 200 ccm. of absolute ether is caused to react with a solution of 30 grams of α-dimethylamino dimethylproprionamide in 100 ccm. of absolute ether. The reaction product obtained after heating for two hours on the water bath yields, after treatment with ice and hydrochloric acid and precipitation with ammonia, 26 grams of α-dimethylamino-propiophenone=70% of theory.

Diaryl-aminoalkyl-carbinols are, as such, sparingly soluble or insoluble in water. Hydrochlorides, sulphates and other salts of such compounds with acids which as a rule form readily soluble salts are also very sparingly soluble in the case of the aforesaid compounds.

It has now been found that readily soluble salts of such compounds of the diaryl-aminoalkyl-carbinols are obtained when they are combined with mono- or polyhydroxy-mono-carboxylic acids. Such acids are for example lactic acid, glycollic acid, quinic acid and the like. The manufacture of saline compounds of diaryl-aminoalkyl-carbinols with such acids can be carried out in various ways. It is possible, for example, to introduce the diaryl-aminoalkyl-carbinol into an aqueous solution of the acid and to dissolve it by intensive mixing, or the acid and carbinol can if desired be melted together with the addition of small quantities of water. It is particularly advantageous to dissolve the two components in an organic solvent, for example ether, and to unite the two solutions. The desired saline compound is then in most cases precipitated in a very pure, crystalline form, and can be separated from the solvent. It is not necessary to use in this method of preparation the same solvent for the carbinol as for the acid. It is also possible to use two different solvents, which should as far as possible be capable of mixing together.

Example XVI

Combination of bis-(1.4-dimethylphenyl)-dimethyl-amino-methylcarbinol with lactic acid

10 grams of bis-(1.4-dimethylphenyl)-dimethylaminomethylcarbinol and 3.1 grams of lactic acid are dissolved separately in ether and the ether solutions are united. After standing for from 1 to 2 days the crystals separated are separated off by suction filtration. The new compound dissolves to the extent of more than 10% in water, while the hydrochloride of the compound is soluble only up to 0.5%, the sulphate and nitrate up to less than 0.2%.

Example XVII

Combination of bis-(1.4-dimethylphenyl)-dimethylaminomethylcarbinol with glycollic acid

10 grams of bis-(1.4-dimethylphenyl)-dimethylaminomethyl-carbinol are added to a concentrated aqueous solution of 2.65 grams of glycollic acid and made to dissolve by intensive stirring and heating on the water bath. The new compound is more than 3% water soluble.

Example XVIII

Combination of bis-(1.4-dimethylphenyl)-dimethylaminomethylcarbinol with quinic acid

6.5 grams of quinic acid and 10 grams of bis-(1.4-dimethylphenyl)-dimethylaminomethyl-carbinol are melted together on the water bath with stirring. The solidified crystalline melt dissolves to the extent of more than 5% in water.

Example XIX

Combination of bis - (1.3-dimethylphenyl) - dimethylaminomethyl-carbinol with lactic acid

10 grams of bis-(1.3-dimethylphenyl)-dimethylaminomethylcarbinol are dissolved in ether and shaken up with an aqueous lactic acid solution which contains 3.5 grams of pure acid. In this way solutions of more than 20% strength can be made. The hydrochloride of the amino-alcohol is only about 0.6% soluble.

Example XX

Combination of bis-(p-methylphenyl)-dimethylaminomethyl-carbinol with lactic acid

10 grams of bis-(p-methylphenyl)-dimethylaminoethylcarbinol and 3.35 grams of lactic acid are dissolved separately in ether and the solutions are combined. The new compound at first separates in an oily state, and can be made to crystallise only with difficulty. In this manner solutions of 50% strength can be made, whereas for example the hydrochloride is soluble only to the extent of 2½%.

A particular advantage of the medicaments of the present invention is that when used on an animal organism they have desirable subsidiary actions, for example many have at the same time a superficial anaesthetic action and the effect of relieving swelling on inflamed mucous membranes. In some cases they posses only one of the two subsidiary actions. The compounds can be applied as such or in the form of their salts, for example as a hydrochloride, benzoate or the like. In this way it is possible to use almost all types of solvent or dispersive agents and to maintain at all times the most favourable hydrogen-ion concentration.

Most of these compounds are in addition non-poisonous, in the quantity required to be used, to the animal organism and are non-irritating even to sensitive mucous membranes.

A few examples will explain this:

An aqueous solution of dimethylaminomethyl-diphenylcarbinol hydrochloride of 2% strength destroys diphtheria bacteria in vitro in 30 minutes. When tested on a rabbit's eye by the bristle method it has a superficial anaesthetic action which is almost equal to that of a solution, also of 2% strength, of cocaine hydrochloricum. In the continuous test, also on a rabbit's eye, even with a 10% solution it was not possible to discover any irritating action.

When a 2% solution is applied to inflamed mucous membranes, distinct relief of the swelling and loss of colour are discernible even after a few minutes. A 2% aqueous solution of dimethylaminomethyl - di - p-tolyl-carbinol hydrochloride kills diphtheria bacteria, in

Vitro	in 5 minutes
B. coli	in 5 minutes
and	
B. streptococci	in 5 minutes

The same solution possesses a surface anaesthetic action approximately four times as strong as that of the first-mentioned compound.

Example XXI

A mouthwash and gargle capable of direct use is obtained by dissolving 5 grams of dimethylaminomethyl-di-2.4-dimethylphenyl-carbinol hydrochloride in 1 litre of water.

Example XXII

Antiseptic dental tincture

Spirit (of 90%) 80, tinctura myrrhae 20 and dimethylaminomethyl-di-p-talyl-carbinol hydrochloride 5. In order to improve the taste suitable substances, for example menthol or etheral oils, can be added.

Example XXIII

Mouthwash tablets

A basic tablet material preferably consisting of sodium chloride is allowed to absorb a solution of dimethylaminomethyl-diphenyl - carbinol - benzoate in alcohol, which contains flavouring additions of peppermint oil, eucalyptus oil or similar etheral oils.

Example XXIV

Antiseptic eyewash

1 gram dimethylaminomethyl-diphenyl-carbinol hydrochloride. 0.7 gram sodium chloride, aqua destillata ad 100.

Example XXV

Antiseptic vulnerary ointment

2% of dimethylaminomethyldiphenyl-carbinol hydrochloride is worked into a base of lanolin ointment.

Example XXVI

For the disinfection of burns the latter are smeared with a 2% solution of dimethylaminomethyl-di-p-tolyl-carbinol in olive oil.

Example XXVII

From a basic soap an antiseptic soap is made in known manner by the addition of 5% of dimethylaminomethyl-di-p-tolyl-carbinol.

Example XXVIII

For the sterilisation of surgical instruments the latter are placed in a 2% aqueous solution of dimethylaminomethyl-di - p - tolyl-carbinol hydrochloride.

Example XXIX

By the addition of 0.2% of dimethylaminomethyl-di-2.4-dimethylphenol - carbinol hydrochloride to a solution of adrenaline it is possible to sterilise the latter and keep it sterilised without the application of heat which is hramful to adrenaline. At the same time the dimethylaminomethyl-di-2.4-dimethylphenyl-carbinol hydrochloride supports the action of the local anaesthetic which may be present in the solution. For some purposes the anaesthetic property of the dimethylaminomethyl-di-2.4-dimethylphenyl-carbinol hydrochloride alone is sufficient.

Example XXX

In order to protect glue or gelatine or solutions of same from attack by bacteria, up to 10% and up to 2% of dimethylaminomethyl-di-p-tolyl-carbinol is added to the former and the latter respectively. If an increased fungicidal action is desired, the salt of a per se fungicidal or disinfecting acid, for example benzoic acid or salicylic acid, is advantageously used, or if desired such salts can be used in addition.

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ALIEN PROPERTY CUSTODIAN

ROCKET PROPELLED BODIES

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Application filed August 14, 1937

Rockets with liquid fuels and rockets with solid fuels are already known as driving or propelling means, among the latter so-called core rockets and fire rockets, which are rockets with solidly pressed driving means the combustion surface of which is at the maximum equal to intersecting surface vertical to the longitudinal axis of rocket, the said surface being circular, which means that there is the drawback that every time only too small surfaces of fuel or driving means, respectively, are ignited,—which is particularly insufficient at the start of such rockets,—for generating the accelerating forces necessary, in that moment. Furthermore the direction of the inflamed gases is parallel to the longitudinal axis of the rocket so that these rapidly moved gases beat the surfaces of the outlet opening (cross section of nozzle) and cannot be so soon deflected as this would be necessary for being capable of using the most energetic propelling means, and must produce explosion of rockets. Furthermore, the surface of inflammation which during the whole combustion remains of equal extension offers no possibility to keep the combustion during the flight of the rocket always such as to be capable of obtaining, for every moment of the flight, the most favorable value of velocity of flight.

Purpose of present invention is to avoid the above said drawbacks always occurring at the state of the art of today as regards production of incendiary rockets, and at the same time obtain further considerable advantages.

The present invention consists in giving the driving means or propellant for each inflammation the only mathematically possible optimum combustion surface and to keep this optimum combustion surface during the whole action of combustion so that the direction of the inflamed gases in dependance from these combustion surfaces always possess the exact direction in the cross section of the neck of the nozzle, which means the exact intersection point of the longitudinal axis of the rocket with the cross section of neck of nozzle to the common mark or butt.

The present invention further consists in obtaining,—by such formation of every combustion surface,—which in the surface part 1 in Figure 1 has double the extension as the surface of same size of known rockets,—always the best flight rate for every moment of the flight, owing to the fact that the change of extension of every inflammation area, with regard to the decrease of weight of rockets during the flight, makes a priori the propellants of the single layers selectable as regards their efficiency.

The efficiency of these single layers of the propelling material, according to the invention, is so determined with regard to the combustion area in each case that for the formation of pressure in the combustion chamber the progressive extension of combustion chamber is calculatorily considered.

Therefore all solid propellents, even explosives, may be used as fuel, and the latter will be preferably controlled as to their rate of evaporation by special mechanical means (such as gelatinisation, etc.). These retardation means, in the shape of slabs of a lower combustion rate, are lodged between the several layers of propelling material, as is shown at *c* in Figure 7. It is also provided by the present invention to introduce into the envelope or shell of the rocket quantities of propelling material in solid form, wrapped in retardation materials, such portions without empty spaces being afterwards, in the envelope of the rocket, airtightly pressed against the inner wall of the envelope of the rocket, Figure 8. Furthermore the envelope of the rocket may be given conical shape, entirely or only at its inner wall, so that the several introduced portions are given a particularly solid seat in the shell. According to the present invention these parts, if necessary, may also be introduced into the rocket shell in the retarding wrapper and only compressed in the shell so as to improve the tight closure of these parts against the inner wall of the envelope or shell, particularly in case of the said wrapper being up to a certain degree elastically yielding, Figure 9. According to the present invention such portions of the propelling material may also be introduced in solid shape, without retarding wrapper, directly into the cylindrical or conical shell, because these portions have no hollows, Figure 10, and firmly compressed against the inner wall of the envelope or shell, in which case inflections are given to the latter, Figure 11, which warrant sure tightness along the inner wall of the envelope, which is a condition sine qua non for avoiding posterior ignition along the inner wall of envelope or shell. If there is no such tight closure, the rocket must explode. If, in fine, the several propelling portions are not introduced in hard condition into the envelope, by compression in the latter, the portion of propelling material is shaped as in Figure 11*a*. If necessary, according to invention, a portion of propelling material is to be provided with inflections at its initial inflammation area, whereby

increase of combustion pressure and consequently intensification of combustion is obtained, because certain propelling materials are the more rapidly and therefor the more efficiently gasified the greater the pressure in the combustion chamber, Figure 12, happens to be.

Object of invention is furthermore to propel the rocket propelled bodies during their flight partly by black gun powder or smokeless powder, and partly by stronger propellants which, if necessary, are influenced by above described retarding means. This may be obtained, according to invention, either in the above described rockets, or in rockets according to Figure 6.

Such rockets in the part forming the continuation of the nozzle may, for instance, contain black; powder. The layers of propelling material *e f* forming continuation of part *c d* in Figure 6 may be constructed as described with reference to Figure 1 or, according to eventual requirements, as shown in Figures 7–12 inclusively.

If a rocket such as shown in Fig. 6 is needed, according to invention a structure such as shown in Figure 3 is possible for the first inflammation area, i. e. that nearest to the nozzle. It is known from Gerasimoff's Patent to provide plural hollows in portions of propelling material closed all around. This may, anologously, also be applied to the portion of propellant nearest the nozzle. However, according to invention, in Figure 3 such portion of propelling material is shown with plural hollows in the very rocket, so that in the first place, instead of a discharge nozzle, a pressure base such as shown in Figure 4 is used, which is removed after compression of rocket is completed, and in its placed a nozzle of any shape or structure is afterwards fixed in the rocket shell. As is known, the nozzles of rockets are always made very short, because in the act of compression they unduly increase the stroke of the press, and furthermore, if very long, they form a considerable part of total weight of rocket. According to invention such nozzles afterwards introduced into the shell are made of materials which do not stand the compression pressure to which a nozzle permanently connected to the rocket shell is subjected, such for instance as wood, which material is then protected against combustion by paint, or by a covering, for instance copper plating, as shown in Figure 3 at *b* and *c*.

Suppose that according to invention a brusque start is to be effected by expelling under the pressure of the developed gases a conveniently shaped closure *e*, Figure 3, disposed at a suitable point in the nozzle.

Fig. 1 is a longitudinal section of a rocket according to invention. *a* is the shell, *b* the nozzle, t_1—t_6 portions of propelling material. 1—6 are layers of the latter, disposed concentrically to the centre of line 1, whilst 1′—4′ are layers of propelling material disposed concentrically to the centre of line 1′.

Fig. 2 is a longitudinal section of an envelope or shell and a base for compression of rocket as shown in Figure 1, where *a* is the shell and *b* the pressure base.

Fig. 3 is a longitudinal section of a rocket according to invention, with a plurality of hollow spaces or cavities in a cross section of the rocket. *a* is the envelope or shell, *b* the nozzle, *o* the covering of wall of nozzle, and *e* the closure of the nozzle.

Fig. 4 shows the contents of a cross section of the pressure base for the compression of a rocket according to Figure 3. *a* is the pressure base with a spindle or punch for the main cavity. $b_1 b_2$ are pins inserted into the pressure base *a*. The said pins will be preferably removed after the compression of the rocket, first each singly, and then the pressure base may be removed in known manner from the shell by rotation.

Fig. 5 is a cross section of Fig. 3. *a* is the envelope or shell, *d* the propelling material, same as in Fig. 3.

Fig. 6 represents a longitudinal section of a rocket containing in one part for instance black powder, and in the other a stronger propellant. *a* is the shell and *b* the nozzle, whilst *d* are portions of propelling material, such as black powder, *e, f, g, h,* and *c* are portions of a propelling stuff, for instance of a more powerful composition.

Figure 7 is a longitudinal section of a portion of propelling material of the rocket according to invention. *a* is the shell, *b* and *d* are portions of propelling material, and *c* retardation means.

Figure 8 is a longitudinal section of the part of propelling material of a rocket according to invention. *a* is the shell, *b* the retardation means, and *c d* the portions of propelling material.

Fig. 9 is a similar longitudinal section, but with a conical shell *a*, retardation means *b* and portions of propelling material *c* and *d*.

Figure 10 is a similar longitudinal section where *a* is the shell, and *b c* are the portions of propelling material.

Fig. 11 is a similar longitudinal section in which *a* is the shell and *b* a portion of propelling material pressed into the shell so as to produce inflections in its inner wall.

Fig. 11 *a* is an equivalent longitudinal section where *a* is the shell, and *b c* are portions of propelling material which in the act of compression produce inflections in the inner wall of the shell on the one hand, and in the other parts on the other hand.

Fig. 12 is a similar longitudinal section where *a* is the shell and *b* the portion of propelling material.

With the above described rockets also graduated rockets may be formed which, as is known, are so that one stage after the other consumes its propelling charge, whereby additional velocity is obtained in known manner, and very long ways may be made.

Owing to this circumstance it is possible to utilize rockets for a new method for rocket propelled bodies.

The new method consists in that with numerous rockets, and precisely as their useful load, a substance designed for pulverisation or gasification is brought to a determined spot in such way that the latter, with the scarce accuracy of aim inherent to rockets, is filled in all its parts with a great number of such rockets, whereupon the ignition of the space so prepared is produced by one rocket. Again for the ignition no great accuracy of aim is needed, because the arrival of the ignition rocket at any point of the prepared space starts inflammation of the whole space.

The substances designed for being pulverized or gasified may become ignitable:

(1) By their mixing with the air,

(2) By being ignitable in themselves, which means without mixing with the surrounding medium, as soon as gasification will be completed.

A method such as above described may, at the one hand, be used in festivals, such as fireworks, for the sudden inflammation of a space, but on the other hand it may also be used for destroying living creatures present in this space. It will be

thus possible for instance to surely destroy locust swarms such as infesting in enorm masses certain countries at certain times, which could not be killed by fire, because such locust masses are not sufficiently combustible, whilst with the present method the single animals will be killed by abstraction or combustion of air for respiration.

It is certainly imaginable that such effects may be obtained with special projectiles, but on the one hand the quantity of substance to be rapidly conveyed into a space are too small, whilst accuracy of aim is excessive, which means that working with projectiles is too costly. Also, owing to the necessity of using special apparatuses for firing the projectiles, working with great masses of projectiles is impossible, and would not be convenient, whilst the above described method, if necessary, may be used with large masses and sufficient efficiency under every point of view, and without material cost, because only very simple rocket frames will be sufficient, and the rockets in themselves are very cheap. Furthermore, working with rockets is almost noiseless, and combustion may be so effected by appropriate structure of rockets that very feeble traces of working will be visible.

As rocket propelled bodies also: rocket bombs for aeroplanes may be considered.

The known aeroplane bombs of various structure and size are launching bombs, which means that they fall down from the air craft by gravity to the ground and are prevalently influenced during their fall by inertia and the surrounding atmospheric conditions.

These circumstances result in all kinds of aircraft bombs, such as bursting bombs, gas bombs and incendiary bombs in a scarce force of impact and scarce accuracy of aim as compared with artillery projectiles.

With gas and incendiary bombs the accuracy of aim and force of impact are not so decisively important as with the most important group of aircraft bombs, namely bursting bombs, especially armour protected bombs, which so not exist hitherto.

With bursting bombs there must be made distinction between:

(*a*) Velocity of fall of bombs, and in connection therewith

(*b*) Action of pure force of impact,

(*c*) Splintering effect of the bombs detonating on or immediately above the ground

(*d*) Effect of pressure of detonation gases which are in well known connection with force of impact and depth of penetration into the ground, respectively.

The velocity of fall, and therefor time of fall of the bombs are prevalently influenced by the cross section load and shape of bomb, and furthermore by the absolute height of fall. As an average, the commonly used modern more or less torpedo-like bombs reach a velocity of fall of at maximum under 250 m/sec. and this velocity remains constant even with the greatest height of fall. Therefor, when this velocity has been reached, the bomb continues to fall at the same rate, because the resistance of air formed in the fall balances the acceleration moment and prevents further increase of velocity. In consequence of such long permanence in differently moved zones of air the aircraft bombs not only show different curves and times of fall with different sizes of bombs, having their cause mainly in the different cross section loads in the different sizes of bombs, but a number of air craft bombs of same size falling at the same time and under the same conditions show very considerable differences in the elements of fall, and precisely in consequence of the very considerable and unfortunately mostly irregular pendulations occurring especially at the beginning.

As regards pure force of impact, the aircraft bomb, owing to its generally very much lower final velocity, is inferior to the artillery grenade. As a further difference of the aircraft bombs from artillery grenades the minor cross section load of the aircraft bombs is to be mentioned, because the latter in spite of their considerable total length have a comparatively greater diameter than the artillery projectiles, the reason of which is the feeble envelope structure and small proportion of metal in comparison with the quantity of explosive material, the greatest possible quantity of explosive matter being the first requirement of all known air bombs.

From the above disclosures it is also obvious that artillery projectiles in themselves, and also all the special propelling means connected therewith, necessarily have wholly different effects from air-bombs, especially as regards the gravity position, decisive for fall and accuracy of aim, and the wide differences as to gravity position between aircraft bombs and artillery projectiles.

In order to reduce the above said drawbacks of all known aircraft bombs the dimensions of bomb have been increased, and by indirect hitting (near the mark) the desired effect was obtained (sinking of ship by breaking the side wall beneath the side armour).

Thus an increase of size of bomb being selected in order to increase accuracy of aim as above said, it was necessary to adopt this increase of size of the bomb also in order to increase force of impact, because the other means to be contemplated, namely increase of velocity of final fall, was not yet realizable with any known aircraft bomb.

Owing to scarce accuracy of aim and force of impact the use of armour protected bombs, though urgently needed in themselves, was not contemplated.

With the increase of weight of the individual bomb and dimensions of same it was impossible to carry a large supply of same if it was desired not to excessively limit the range of flight of bomb carrying aeroplanes, and also the chance of hitting with one or a few bombs was reduced.

With aircraft bombs with prevalent splintering effect, such as necessary for bombarding living marks, in order to increase chance of hitting, launching in masses was resorted to, as force of impact was not prevalently required.

The present invention consists in inserting, into aircraft bombs, a rocket, having at the same time care to construct the aircraft bomb, as regards shape and gravity position, in appropriate form so as to obviate the above said inconveniences, especially want of accuracy of aim and scarce force of impact, and creating definite flight curves for rocket driven aircraft bombs and thereby obtaining new effects of use and action of such rocket driven aircraft bombs, and also consists in obtaining by appropriate connection of an air bomb of dimensions corresponding to the rocket propulsion with a smaller size of rocket with equal efficiancy as to force of impact, and at last in the possibility of obtaining equal curves of flight for all sizes of bomb, and with certain types of bomb obtaining and controlling detonation of contents by combustion of rocket.

By insertion of a rocket into an aircraft bomb

in order to obtain full gravitation, the propelling force of the rocket is fully added, the velocity of flight is multiplied, and therefore according to the known laws of final and impact velocity, also the force of impact is multiplied, and at the same time the accuracy of aim materially improved by shortening the time of flight and therefore shortening the permanence in differently moved air zones, and multiplication of accuracy of aim in comparison with all other aircraft bombs obtained according to present invention by the fact that with any desired size and any desired variety of selection of propelling power of rocket, by appropriate co-operation of propelling force of rocket with gravitation and inertia, pre-establishable curves of flight for rocket propelled aircraft bombs are obtained from start to butt. By the insertion of the rocket the same force of impact is obtained with reduced sizes of bomb owing to the multiplied part of impact velocity of such rocket propelled bombs in the total of impact force.

The cross section loads varying for different sizes of aircraft bombs, by appropriate selection of magnitude, case for case, of propelling power of rocket for the various sizes of bomb, are harmonized with each other or respectively made of same size and given equal curves of flight for different sizes of bomb, and therefore the same aiming device may be used for different sizes of bomb.

It is also comprised in the present invention that the acting part of propellent charge is in every case such with regard to the developed propelling force that the cross section load of the rocket propelled aircraft bomb as a value resulting especially from propulsion of rocket, gravity and air resistance reaches its maximum at the end of the flightway. This is obtained by appropriate shaping of body with regard to the velocity of flight occurring, and furthermore by appropriate curves of flight and appropriately selected extension of instantaneous inflammation area of the charge of propelling material.

Furthermore in the rocket propelled air-bomb, especially when armour protected, ignition of explosive charge of bomb is directly effected by the propelling charge of the rocket, which may be done mechanically chemically or electrically.

A modification of idea of invention consists in effecting ignition so that these rocket propelled bombs when detached from the aircraft rather near the ground (for instance 100 m beneath the aircraft) and then already hit the mark, have no energetic action. This means that in such case the explosive charge of the rocket propelled bomb is not ignited, which is obtained for instance with rocket bombs turning on their longitudinal axe, by the fact that the igniting mechanism constructed for instance as a centrifugal controller, has not yet sufficiently oscillated, or that for instance a hammer-like body in such cases falls on the device connecting the propelling charge with the explosive charge thereby separating same in this or another way, or respectively their influence is arrested so that for instance the rocket ceases burning, or only burns out without having acted on the explosive charge of the bomb.

This kind of ignition makes than possible at the head of the bomb the ignition hitherto used with bombs, and this is particularly important for armour protected rocket bombs, because these are designed for penetrating through, or deeply into the butt before exploding through the action of the igniter. In this way it is possible to give the head of the bomb a hardened point particularly adapted for penetrating into fixed butts, and furthermore with correspondingly higher rates of flight, the rocket propelled body by giving it a suitable shape may be made more solid, but not heavier than the same body without rocket propulsion.

In the drawing, Fig. 13, longitudinal section of such rocket propelled bomb is shown. *a* is the head of the bomb and respectively the body proper, *b* the explosive charge of the bomb, *c* the igniter,—to be acted upon by the rocket,—for the charge of the bomb, *d* the rocket, *e* the steering part of the rocket propelled bomb, and *f* a rocket igniter to be placed in the discharge opening of the rocket.

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PUBLISHED

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BY A. P. C.

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ROCKET PROPELLED BODIES

Filed Aug. 14, 1937

Serial No. 159,143

2 Sheets-Sheet 1

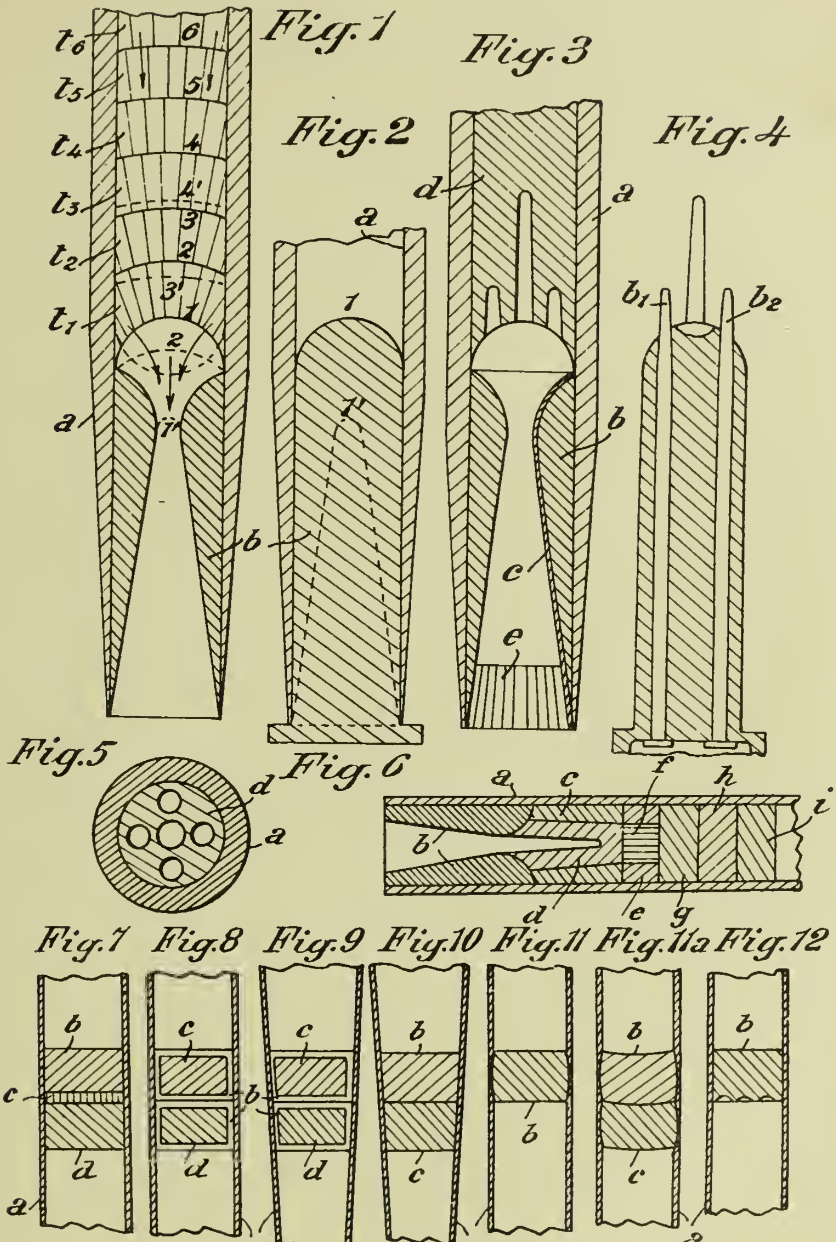

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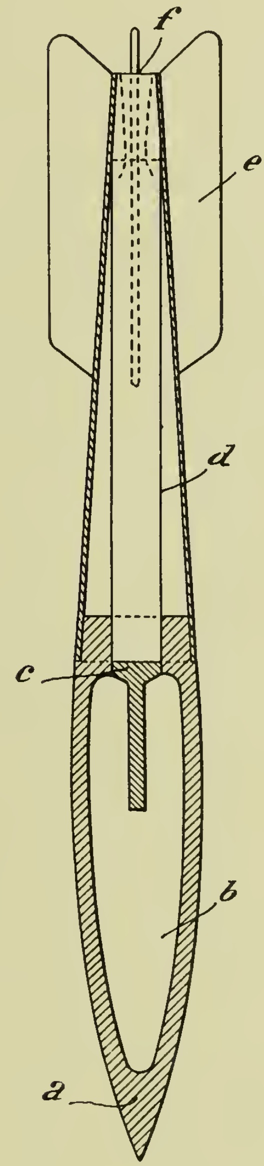
Fig. 13



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ALIEN PROPERTY CUSTODIAN

PROCESS AND DEVICE FOR ELECTRICAL CALCULATION

Fritz Mezger, Paris, France; vested in the Alien Property Custodian

Application filed May 24, 1938

This invention relates to calculating apparatus and has for its object to provide an apparatus which performs multiplication in a novel manner.

Multiplication is effected mentally by multiplying one factor, the multiplicand, by each digit of the other factor, the multiplier, to obtain a series of partial products and finally adding these partial products together. Each operation in the process consists in the calculation of the multi-denominational partial product which is the product of the multiplicand by a single digit of the multiplier. The product of a multiplicand digit and a multiplier digit comprises, in general, a two figure number, and it is therefore the practice to multiply a multiplicand digit by a multiplier digit, to add, to the units digit of the product, the tens digit of the product of the next lower multiplicand digit and the same multiplier digit and to carry forward the tens digit of the first-mentioned product together with the tens digit, if any, resulting from the addition of the units digit of that product to the tens digit of the second mentioned product. The digits of the various interdigital products calculated during the process are thus not written down. Multiplying machines of the partial product kind constructed hitherto operate in substantially the above method with the modification that two partial products are obtained at each operation, one consisting of the units digits and the other of the tens digits of the products of each digit of the multiplicand by a single digit of the multiplier. The summation of the partial products proceeds concurrently with their calculation, the two partial products resulting from one operation being either formed consecutively and added in a single counter or formed simultaneously and added in separate counters to provide two partial products which are subsequently added together.

A method of performing multiplications mentally is, however, known in which all the digits of the various interdigital products are written down. This method is shown in diagrammatic form in Figure 14 of the accompanying drawings, the table showing by way of example the multiplication of 762 by 948. The factor 762 is written along the top side of a rectangle while the factor 948 is written from the bottom upwards along the left-hand side of the rectangle. The rectangle is divided into squares as shown, so that there is one square for each pair of digits taken one from each factor. Each square is divided diagonally by the dotted lines as shown and in it is written the product of the digit vertically above it and the digit horizontally to its left. The units digit is written above the diagonal of the square, the tens digit is written below the diagonal of the square. The digits are then added diagonally, starting from the top right-hand corner and adding together all the digits lying between two diagonal lines. If the sum of the digits added together is more than 9, the tens digit is written in the next diagonal space and is added in with the digits in that space. In the example shown, the product is 722376.

Considering the diagonal space A on the table of Figure 14, the sum 23 which is obtained is the sum of the units digit of 7×8, the tens digit of 6×8, the units digit of 6×4, the tens digit of 2×4, the units digit of 2×9 and one unit transferred from the previous summation. It will be noted that this summation is a summation of units and tens digits, alternately, of interdigital products plus a transferred unit. It should also be noticed that the first summation involves the units digits of both factors, the second summation involves the units and tens digits of both factors, the next two summations involve all the digits of both factors, the fifth summation involves the tens and hundreds digits of both factors and the last involves the hundreds digits of both factors.

The method of multiplication just described comprises two stages, the first being the calculation and writing down of all the various interdigital products needed and the second stage consists in the diagonal summation of the digits of these products and comprises a separate summing operation for each diagonal row of digits. The present invention provides calculating mechanism which operates generally in accordance with the above method but which combines the two stages and performs a sequence of operations each of which consists in the calculation of all the product digits shown in a diagonal row in the above table and their summation as a single operation. A diagrammatic representation of the process is obtained if one of the factors (948) is considered to be stationary while the other factor (762), written backwardly as 267, is moved to-

wards the left step by step into successive positions designated 0, 1, 2, etc. in Figure 13 of the accompanying drawings, each position corresponding to a stage in the process. In each position the product digits are summed as indicated by arrows in the example for position 1 which follows:

2 6 7

↗ ↘ ↗

9 4 8

The units digits of the products indicated by the arrows ↗ are calculated and the tens digits of the products indicated by the arrows ↘ are also calculated and these tens and units digits are added together and to the digit, if any, carried from the previous summation to give a digit of the final result. The complete operation may be set out in the following manner:

Position	Partial products in which only—		Result
	The tens	The units	
0		8×2 6	6
		4×2 8	
1	2×8...	1	
		8×6 8	
		(1)7	7
		Transfer	
2....	....	1	
		9×2 8	
	?×4...	0	
		4×6 4	
	6×8...	4	
		8×7 6	
		(2)3	
		Transfer	
3		2	
	2×9...	1	
		9×6 4	
	6×4...	2	
		4×7 8	
	7×8...	5	
		(2)2	2
		Transfer	
4		2	
	6×9...	5	
		9×7 3	
	7×4...	2	
		(1)2	2
		Transfer	
5		1	
	7×9....	6	
		7	7

In accordance with the present invention any tens or higher digit resulting from the formation in a particular operation in the process is ignored in doing the summation and only the units digit of the sum is calculated. Special provision is made for determining the tens digit resulting from any summation and for including it in the next summation. This provision is based upon the following considerations:

If any number in the decadal notation is expressed in a notation having the base G and the units digit of the number to the base G is subtracted in accordance with the notation to the base G from the units digit of the decadal number, a difference will be obtained which is constant for the decade in which that number occurs. Subtraction in accordance with a base G merely differs from subtraction in the decadal system in that when a larger digit is to be subtracted from a smaller digit the number G is added instead of 10 to give a positive result digit. It is preferable that the numbers 10 and G should have no common factors. In particular, if G is 11 the units digit of the result of subtracting from the original number in the decadal system the same number re-expressed in the hendecadal system to the base 11 will be the tens digit of the original number. The truth of this can be seen from the consideration that the conversion to the hendecadal system involves the reduction of the units digit of the amount by as many units as the value of the tens digit of the number expressed in the decadal system. For example, 17 is re-written on the hendecadal system as 16 and the difference is 1 which is the value of the tens digit. 30 is rewritten as 28 and the difference 30—28 on the hendacadal system, is 3 which amount is the tens digit of the original amount. It should be noted that the difference can be obtained by subtracting the units digits one from the other and without any regard to the tens digits, which need not be calculated. For example, in the case of the last example 0+11—8=3.

A relationship between the difference and the tens digit of the original amount also exists for notations on other bases, although the relationship is not a direct one, as it is on the base 11 can be used provided that the largest sum that can be formed in any operation does not exceed 109, when the difference will be equal to the digit 10 on the hendecadal notation. If the largest sum that may occur exceeds 109, it is necessary to use an auxiliary notation on a larger base than 11 to permit of the difference being greater than 10. For example, the notation to the base 13 allows of a difference as great as 12 in that notation, 12 being, of course, a single digit in the notation to the base 13. The following table gives the different decades in the notations on the bases 9, 11 and 13.

Deeadal regions	Differences between the units digit in the system on the hase 10 and on the hase—		
	9	11	13
0- 9	0	0	0
10- 19	8	1	3
20- 29...	...7..	...2..	...6.
30- 39	6	3	9
40- 49	5	4	12
50- 59...	...4..	...5..	...2
60- 69	3	6	5
70- 79	2	7	8
80- 89...	...1..	...8..	..11
90- 99		9	1
100-109		10	4
110-119...	......	......	...7
120-129			10

According to the present invention there is provided a calculating mechanism for multiplying two factors together in a succession of stages to obtain a single result digit in a normal notation, comprising means operable to calculate, at each stage, the digits of interdigital products pertaining to that stage and to sum said product digits in the normal notation and in also a special notation so as to obtain the units digits of the sum alone in each case, means for obtaining, at each stage, the difference between the two said digits, obtained at that stage and for adding into the sum obtained in the next stage a digit corresponding to said difference and equal to the tens digit of the sum obtained in the normal notation in the previous stage.

The present invention further provides an electrical system for performing multiplication in accordance with the method previously described.

A further feature of the invention consists in the provision of apparatus for evaluating expressions of the general form $D+/-AB=R$ and which comprises means for including in the sum formed at each stage the appropriate digit of the term D.

An electrical calculating system in accordance with this invention will now be described by way of example only with reference to the accompanying drawings in which:

Figures 1 and 2 are side and front views respectively of the machine, parts of the casing being broken away to show the internal construction. The parts shown broken away in the upper right and left hand corners of Figure 1 correspond respectively to sections on the lines M—M and N—N in Figure 2.

Figure 2A is a circuit diagram showing the method of controlling an electric motor driving a commutator forming part of the machine.

Figure 3 is a section through the keyboard along the line **3—3** in Figure 2.

Figure 4 is a section along the line **4—4** in Figure 3.

Figure 5 is a section along the line **5—5** in Figure 2 and shows one of the indicators of the result register.

Figure 6 is a vertical section through the result indicator along the line **6—6** in Figure 5.

Figure 7 is an enlarged view of the connection frame which is seen in the upper left hand corner of Figure 1.

Figure 8 is a section along the line **8—8** in Figure 7.

Figure 9 is a side view of an electromagnetically operated multi-contact switch unit a large number of which are used in the construction of the machine.

Figure 10 is a section along the line **10—10** in Figure 9.

Figures 11A and 11B constitute a diagram showing the various parts of the apparatus in a diagrammatic manner and typical electrical connections between them. The connections established during one stage of the operation of the machine are shown in full lines. This figure does not constitute a circuit diagram.

Figures 12A and 12B constitute a similar diagram of Figures 11A and 11B but show the connections established at another stage of the operation.

Figure 13 is a diagram illustrating successive stages of a multiplying operation.

Figure 14 shows the method of multiplication already referred to.

Figures 15, 16 and 17 are diagrams showing respectively the different series of switches pertaining to the calculation of the units, tens and hundreds denominations of the result.

Figures 18A, 18B, 18C, 18D, 19A, 19B, 19C, 19D, 20A, 20B, 20C, 20D, 21A, 21B, 21C, 21D, 22A, 22B, 22C, 22D and 23 are circuit diagrams for the switches and show how the switches co-operate to perform calculations.

Figure 24 is a circuit diagram showing the method of operating the electromagnets controlling the switches shown in Figures 18A, 18B, 18C, 18D, 19A, 19B, 19C and 19D.

Figure 25 is a similar circuit diagram showing the method of operating the electromagnets controlling the switches shown in Figures 20A, 20B, 20C, 20D, 21A, 21B, 21C, 21D, 22A, 22B, 22C and 22D.

Figure 26 is a diagram showing how Figures 18, 19, 20, 21A, B, C and D and Figure 23 may be pieced together to trace continuous circuits during different stages in the operation of the machine.

Figures 27, 28 and 29 are connection tables for three kinds of switches by which the factors are set up in the machine and which control multiplying and subtracting operations.

Figures 30, 31A and 31B are connection tables relating to the commutating means for establishing these series of switches.

The general arrangement of a machine constructed according to the invention is shown in Figures 1 and 2. The machine stands upon a base **200**, the front, top and back of the casing being formed by metal sheets **201** joined at the corners by angle irons **203**. A number of frames **204** run round the interior of the casing and serve to support the side walls **205** and the members accommodated in the interior of the machine.

Mounted on the frames **204** in the upper part of the casing are a large number of electromagnetically operated multiple-contact switches **206**, whence depart bundles of wires **207** (Figure 2) terminating at connection frames **208** situated at the same height. The construction of the switches and connection frames will be further described hereinafter. In the lower part of the casing is housed a commutation cylinder **209** the shaft of which is carried in bearings **210**. The commutation cylinder **209** is driven by an electric motor **211** through a reducing gear **212** and a combined electromagnetically operated clutch and stop device **213**. The commutation cylinder together with the motor, reducing gear, clutch and stop device are mounted on a platform **214** supported by rails **215**. A number of rows of contact brushes **216** are disposed around the commutation cylinder **209** and are joined individually to the blades **217** of a connection frame **218** arranged above the commutation cylinder. The commutation cylinder is of the usual construction and comprises a large number of insulated contact segments **219** the arrangement and interconnection of which will be described hereinafter.

A bracket **220** projects from the front of the casing and carries the keyboard **221** and the result register **222**. The machine here described by way of example is arranged to evaluate expressions of the general form $D-AB=R$, the factors A and B having three and two digits respectively and the term D four digits. Consequently the keyboard **221**, details of which are shown on a larger scale in Figures 3 and 4; comprises three rows of keys **223** for the factor A, each row containing ten keys numbered individually from 0 to 9, two similar rows **224** for the factor B and four similar rows **225** for the term D. As shown in Figures 3 and 4 the keys are raised resiliently by springs **226** and at their lower ends carry cam members **227** whereby contact pairs **228** are closed when the key is depressed. All the keys **225** relating to the term D close single contact pairs as shown in Figure 3, but the keys **223** and **224** relating to the factors A and B close multiple contacts in a similar manner. The number of contacts closed by each key will appear from the subsequent description. After being depressed the keys are prevented from rising by locking plates **229** pivoted at **230** and urged by the springs **231** against the cam members **227**. It is thus possible, by depressing the appropriate keys in the

different rows (one per row) to set up the factors A and B and the term D. After the calculation has been effected the keys are released by a release key or trigger 232 which is pivoted at 233 to a bar 234 having projections 235 which are adapted to engage the plates 229 to push them aside and release the keys when the trigger is operated. The closing of the contact pairs 228 energises the operating magnets of the corresponding switches 206 to establish the connections corresponding to the introduction of the digits interventing in the calculation. When the calculation has been completed, operation of the trigger 232 releases the keys as already described and also, by means of a projection 236 on the bar 234, temporarily closes a contact pair 237 whereby resetting magnets of the switches are energised and the switches are returned to their starting positions.

The keyboard also carries a switch 238 for starting the electric motor 211. For the performance of each calculation the commutation cylinder 209 must be turned through a quarter of a revolution, and Figure 2A shows diagrammatically the arrangements provided for this purpose. The commutation cylinder 209 is driven from the shaft 239 of the reducing gear 212 through a magnetically operated clutch and stop device indicated generally by the reference 240 The driven plate 241 of the clutch is fixed to the commutator shaft 242 and is provided with four equally spaced projections 243 adapted to be engaged by a stop member 244 pivoted at 245 and urged into engagement with the projections by a spring 246. The part of the stop member projecting below the pivot 245 is formed as an armature for an electromagnet 247 whereby the stop member may be disengaged from the projections 243. The driving plate 248 of the clutch is held in engagement with the driven plate 241 by an electromagnet 249 acting through a lever 250 pivoted at 251 and provided with a pull-off spring 252. Clutch and stop mechanisms suitable for the present purpose are already well known and Figure 2A is intended to be regarded simply as a conventional diagram for the purpose of explaining the operation. 253 indicates the magnet of a relay for closing the circuit of the motor 211 from the supply leads 254 and 255. The windings of the magnets 247, 249 and 253 are connected in parallel, one connection being made to the supply lead 254 and the other to one of a pair of brushes 256 co-operating with segments 257 on the surface of the commutation cylinder. Each segment extends over practically a quarter of the circumference of the cylinder and the arrangement is such that the leading brush runs off a segment as a projection 243 of the stop mechanism approaches the stop member 244. The other brush 256 is connected to the supply lead 255, and the switch 238 for starting the operation is connected between the two brushes. In the operative position the commutation cylinder is stopped in a position in which one of the brushes 256 rests on the insulating portion of the cylinder. If the switch 238 is now closed, the magnets 247, 249 and 253 are energised so that the stop member 244 is retracted, the clutch plates 241, 248 are brought into engagement and the motor circuit is completed. The motor 211 therefore starts and drives the commutation cylinder so that both brushes 256 run on to one of the segments. If the switch 238 is now allowed to open, the motor continues to drive the commutation cylinder until the leading brush 256 runs off the segment 257. The circuit of the magnets 247, 249 and 253 is thereby interrupted, so that the stop member 244 is released and engages with one of the projections 243 to stop the rotation of the commutation cylinder. At the same time the clutch is disengaged and the motor circuit is interrupted so that the motor runs freely until its momentum is exhausted and it comes to rest.

The result register is situated above the keyboard 221 and comprises five windows 258 for the five digits of the result. Figures 5 and 6 show the construction on a larger scale. For each denomination of the result there is provided an indicator 259 comprising a sector-shaped scale 260 secured to an iron rotor 25 mounted on a shaft 261 and arranged at the centre of two coils 23, 24 at right angles to one another. The shafts 261 of the various indicators are carried in bearings 263 attached by screws 264 to a rail 265 running from side to side of the bracket 220. The coils 23, 24 are also fixed to the rail 265 by connecting strips 266. The scale 260 of each indicator has inscribed on its external face the ten characteristic decadal digits 0 to 9 and corresponds to one denomination of the result. These result indicators are shown diagrammatically on the right hand side of Figure 11B, UD being the units decadal indicator, TD the tens decadal indicator and so on to TTD which is the ten thousands decadal indicator. As will be seen from Figure 11B, one end of the coils 23 is connected to one end of the coils 24 and to the negative current supply lead L of the machine. The other ends of the coils 23 and 24 are connected by leads L_1 and L_2 respectively to the ends of resistances W which are provided with ten tapping points to which are connected the ten result leads on the decedal system designated 0R to 9R. The suffix 0, 1, 2, 3 or 4 indicates the denomination to which the leads pertain, 0 indicating the units denomination, 1 the tens denomination, etc. When the machine is operated, one of the result leads 0R to 9R of each of the decadal indicators is rendered alive so that a resultant magnetic field is produced by the coils 23, 24 whose direction is determined by the ratio of the magnetising currents of the two coils and is thus independent of variations in the voltage at which the apparatus is supplied with current. The current will branch through the resistance W and the lines L_1 and L_2, and the ratio of the intensities of the currents in the two leads will vary in accordance with which of the result leads 0R to 9R is included in the circuit. Thus, the rotor 25 will take up a position determined by which result lead is included in the circuit and corresponding to a result digit which appears in the window 258. The indicators are not provided with return springs, so that each rotor will remain in any position to which it is moved when its windings are energised, after those windings have been de-energised. In other words, each indicator moves from one indicating position to the next and does not return to zero unless the digit to be indicated in zero.

The machine here described by way of example uses the hendecadal system as the auxiliary base in order to obtain the correct carrying from one denomination to the next according to the principle already explained. For this purpose the result register also comprises for each denomination except the highest (there being then no carrying to be effected) a second result indicator represented generally by the reference 267. The construction of the hendecadal indicators 267 is similar to that of the decadal indicators 259 except that no scale 260 is required. The shafts 268

are carried in bearings 269 fixed to a rail 270 similar to the rail 265. The hendecadal indicators are shown diagrammatically on the right hand side of Figure 11B, UH being the units hendecadal indicator, TH the tens hendecadal indicator and so on to the thousands hendecadal indicator. The coils 23 and 24 of the hendecadal indicators are joined by leads L_1 and L_2 to the ends of resistances W which are provided with eleven tapping points to which are connected the eleven result leads on the hendecadal system designated OR′ to IOR′. The suffix 0, 1, 2 or 3 again indicates the denomination to which the leads pertain. The hendecadal indicators operate in the same way as the decadal indicators except that they may take up any one of eleven positions and in passing from lower to higher digit positions rotate in an anticlockwise direction instead of a clockwise direction.

As already explained, the transfer or carrying from one denomination to the next is determined by the difference between the results obtained on the decadal and hendecadal systems. For this purpose the two indicators 259, 267 pertaining to each denomination except the highest jointly control by gear wheels 271, 272 respectively a differential switch mechanism generally indicated by the refernece 273.

Each differential switch comprises a base 274 with side portions 275, 276 carrying a shaft 277. Loosely mounted on the shaft 277 are gear wheels 278, 279 meshing respectively with idler gear wheels 280, 281 meshing with the gear wheels 271, 272. The gear wheels 278, 279 are also provided with bevel teeth 282 meshing with planetary bevel pinions 283 mounted loosely on a cross shaft 284 made in two halves screwed together. A disc of insulating material 285 is secured to the side portion 276 by screws 286 and carries an inner contact ring 20 and an outer concentric row of contact segments 21. An arm 289 is fixed to the shaft 277 and to its outer end is secured a contact bridge piece 290 by means of a stirrup 291. Wiring connections to be described later are made to the contact ring 20 and to the contact segments 21. During the operation of the machine the decadal and hendecadal indicators pertaining to a denomination of the result are energised successively. Supposing that both indicators are originally in the zero position, the shaft 261 of the decadal indicator is first turned to the position corresponding to the particular digit of the result, while the shaft 268 of the hendecadal indicator remains stationary. During this period the gear wheel 278 is turned by the gear wheel 271 and the shaft 277 is turned by the planetary pinions 283 so that the contact bridge piece 290 moves over a number of contact segments 21 equal to the said digit. The shaft 261 then remains stationary while the shaft 268 is turned to the position corresponding to the particular digit of the result in the hendecadal system. During this period the gear wheel 279 is turned by the gear wheel 272 and the shaft 277 is turned by the planetary pinions 283 so that the contact bridge piece 290 moves back over a number of contact segments equal to the said hendecadal digit. The contact bridge piece 290 therefore finally comes to rest on a contact segment 21 corresponding to the difference between the digits in the decadal and hendecadal systems. The same final position will, of course, be arrived at when either or both indicators start from a position other than zero. The gearing ratios between the driving wheels 271, 272 and the gear wheels 278, 279 are preferably selected so as to compensate the difference in rotation of the shafts of the decadal and hendecadal indicators. The four differential switches are shown diagrammatically on the right hand side of Figure 11A, DS_0, DS_1, DS_2 and DS_3 being respectively the switches driven by the indicators of the units, tens, hundreds and thousands denominations.

The digits of the term D and of the factors A and B of the expression $D-AB=R$ will be designated $d_0, d_1, d_2 \ldots a_0, a_1, a_2 \ldots$ and $b_0, b_1, b_2, \ldots$ respectively, the suffixed numerals indicating the denominational value of each digit, 0 indicating the units denomination, 1 the tens denomination and so on. Each digit is entered by a separate switch which is adjustable into any one of ten positions by the ten keys of the corresponding row of the keyboard 221, so that each position corresponds to a different digit. The switches for the term D will be designated SD0, SD1, SD2, etc. The switches for the factor A will be designated SA0, SA1, etc. and the switches for the factor B, SB0, SB1, etc. Each of these switches is a multi-contact switch built up from a number of similar electromagnetically controlled units and makes a different predetermined set of connections for each position. The construction of the switch units and the manner in which they are grouped together to form a switch SA, SB or SD, using these designations generically, will be described more, fully hereinafter.

The apparatus also comprises a commutator, already referred to by the reference numeral 209, which turns continuously while a calculation is being effected and connects the switches together in different series at each stage in the operation. Each series comprises switches SA and SB arranged alternately and followed by one of the switches SD. The switches which are connected in series at any stage depend upon the factor digits which are involved at that stage and this series of switches provides a series of circuits corresponding to all possible results at that stage and terminating in ten result leads, if the calculation is proceeding on the decadal notation, and 11 result leads if the calculation is proceeding on the hendecadal notation. The setting of the switches selects uniquely one of these circuits so that one of the result leads is alive. At each stage a result digit is calculated first on the decadal notation and then on the hendecadal notation. The connection of the result leads to the indicating devices of the result register has already been described with reference to Figures 5, 6 and 11B. The latter figure is a continuation towards the right of Figure 11A.

The indicators are connected in circuit in turn by the commutator 27 as will be described later, starting with the units decadal indicator UD followed by the units hendecadal indicator UH, the tens decadal indicator TD, the tens hendecadal indicator TH and so on up to the ten thousands decadal indicator TTD. Thus at each stage the appropriate decadal indicator is energised and will indicate a digit of the result. This digit is the units digit of the sum and is in the decadal notation. The hendecadal indicator for the same denomination is then energised and indicates a digit which is the units digit of the same sum when expressed in the hendecadal notation. By means of the differential switches DS_0, DS_1, etc. the two indicators of each pair jointly control the addition into the sum formed at the next stage of the tens digit of the sum formed at the stage in which they are set. The contacts 21

of each differential switch are permanently connected to lines 22 leading to the first switch of the series of switches established in the next stage of the operations and so as to determine through which of eleven arrival lines of this first switch the circuit is to be completed. Only the first of these arrival wires has been shown in Figure 11A. The effect of this selection of an arrival line will be apparent from the description which is to be given later.

The commutator 26 in the left hand upper corner of Figure 11A moves in the direction of the arrow, and in the first stage of the calculation makes a connection from the positive pole of the source of current to the arrival line a_0 of the switch SA_0, which is the first switch of the series for calculating the units denomination of the result. Thereafter it connects the positive pole of the source of current successively to the contacts 20 of the differential switches DS_0, DS_1, DS_2 and DS_3 as the different series of switches are established for the calculation of the higher denominations of the result.

In order that the indicating devices should operate correctly the load on the rotors must be very small, and instead of driving the differential switches directly as described, it may, therefore, be preferred to employ the rotors merely as relays to control follow-up servo-motors, in the manner well-known in ships-compasses and like remote indicating devices, and these motors may control the differential switch mechanism.

Each switch SA or SB consists essentially of two parts which are adjustable together. One part of the switch may be termed the tens part and is indicated by the reference T and the other the units part and is indicated by the reference U. The tens part of each switch SA and the tens part of the switch SB preceding it in the series are electrically connected together during the operation of the machine and co-operate, while the units part of each switch SA is electrically connected to and co-operates with the units part of the switch SB which follows it in the series. Each pair comprising the tens part of a switch SB followed by the tens part of a switch SA serves to calculate the tens digit of the product of the two digits represented by the setting of the two switches and to add this digit to the sum of the digits calculated by the pairs of switch parts earlier in the sequence of switches. Each pair comprising the units part of a switch SA followed by the units part of a switch SB serves in similar manner to calculate the units digit of the product of the digits represented by the setting of the switches. The switches are built up from a number of electromagnetically operated units of the kind shown in Figures 9 and 10. Each unit comprises a ring of fixed contacts 292, 293 mounted on a segment of insulating material 294 fixed to the frame 295. The contacts 292 are wider than the contacts 293 and are arranged alternately therewith. Each contact 292, 293 is provided with a tab 296 for making soldered connections to the wiring. A ring of moving contacts 297 are embedded in a disc 298 of insulating material mounted on a spindle 299 supported in bearings in the frame 295. Each movable contact 297 is in the form of a split blade of the same width as the fixed contacts 292. The disc 298 carrying the movable contacts is driven in reciprocatory rotation about its spindle 299 by one end of a lever 300 pivoted to the frame at 301 and forming at its other end a movable armature 302 placed between the poles 303, 304 of two electromagnets 305 and 306. When the magnet 305 is energised the lever 300 is moved in an anticlockwise direction and by means of a pin 307 in its lower end moves the insulating disc 298 in a clockwise direction so that one part of the split movable contacts 297 moves off the wide fixed contact 292 on to the adjacent narrow fixed contact 293. Each wide contact 292 is thus electrically connected to the adjacent narrow contact 293. The excitation of the other electromagnet 306 conversely returns all the moving contacts to the position shown in Figure 9. These electromagnetically operated units are mounted in the casing as indicated at 206 in Figures 1 and 2 and from the tabs 296 wires of the bundle 207 lead to connection frames 208, shown on a larger scale in Figures 7 and 8, where they are connected to metal blades 308 embedded in insulating bars 309 fixed to transverse rails 310. The blades 308 of the various bars 309 are aligned in the transverse direction of the bars so that these blades may be connected by wires 311 to carry out the connections presently to be described.

Figures 18A, 18B, 18C and 18D show one of the switches SB. Figure 18B is a continuation to the right of Figure 18A, these two figures completing the units part of the switch. Similarly, Figure 18D is a continuation towards the right of Figure 18C and these two figures together form the tens part of the switch. The table labelled "Switch B" which extends across the top of these figures indicates the digital settings of the switch for which particular contacts will be closed. Where a dash appears in a horizontal column of the table the contacts vertically in line with that dash will be closed, in the direction of the adjacent arrow, when the switch is set to register the digit at the end of the horizontal column. For example, if the switch is set to record 4, then in the part of the switch shown in Figure 18A the fourth row of *k* contacts, the second row of *l* contacts, the fourth row of *m* contacts and the third row of *n* contacts will all be closed. Similar remarks apply to the contact shown in Figures 18B, 18C and 18D.

Each of these rows of contacts is constituted by a group of the contact pairs 292, 293 of an electromagnetically operated switch unit shown in Figures 9 and 10, and the operating electromagnets are indicated diagrammatically above the tables vertically above the contacts which they operate. For example, referring to the nine rows of contacts marked *k* in Figure 18A, each row comprises eleven contact pairs numbered 0 to 10, and is on a different switch unit. The closing magnets of these nine units are shown vertically above the corresponding rows and are marked 100, 101, 102 . . . 108. When the switch is set to register a digit from 1 to 9 inclusive one of these magnets is energised, as indicated by the dash in the horizontal column pertaining to that digit, so that the disc 298 (Figure 9) of the corresponding switch unit is rotated and the contact pairs 292, 293 of the group are connected together. In Figure 18A there are also nine rows of contacts marked *l*, and as the registration of digits from 1 to 9 inclusive also in this case only involves the closing of one row of contacts at a time, each of these rows may be paired with one of the rows *k* so that the same magnet closes the contacts of both rows. Thus, for example, the first row of contacts *k* and the third row of contacts *l* are both closed when the digit 1 is set up and may therefore both be mounted in the same

switch unit so as to be closed by the same magnet 100. For convenience, in Figure 18A the magnets 100 to 108 have been repeated above the rows of contacts l. In the case of the four rows of contacts m, it will be seen that each row is closed when two digits are set up, for example the first row is closed when the digits 1 to 6 are set up, and to avoid the formation of back circuits in the magnet wiring system, which will be described presently, such rows can only be paired with other rows which are closed when the same two digits are set up. The first row of m contacts is therefore paired with the second row of n contacts and all these contacts mounted on the same switch unit and operated by the same magnet 109. The remaining rows of contacts on Figures 18A, B, C and D are allocated to different switch units according to the same principle as may readily be followed by reference to the table and the numbering of the operating magnets.

Figure 24 shows how the operating magnets pertaining to the switch SB are controlled by the keyboard. 100 to 126 inclusive are the closing magnets shown in Figures 18A, 18B, 18C and 18D, and 100' to 126' inclusive are the corresponding magnets for returning the switch units to the open position. One terminal lead of each magnet is permanently connected to the negative current supply line, and the other terminal lead of each of the opening magnets 100' to 126' inclusive is connected to a common line leading to one of the contacts of the contact pair 237 operated by the trigger 232 (see Figure 4). The other contact of the pair 237 is connected to the positive current supply line. Operation of the trigger 232 therefore releases all the keys which have been depressed, as already described, and also energises all the magnets 100' to 126' to return the switch units to the open circuit position. The closing magnets 100 to 126 inclusive are controlled by the keys 0 to 9 which are one of the rows of keys 224 shown in Figure 2. The other row of keys 224 controls an identical system of magnets pertaining to the other switch SB. When a key is depressed all the contacts shown in a group below it are connected together. When the key 0 is depressed to register the digit 0 in the switch SB under consideration it will be seen from the tables of Figures 18A, 18B, 18C and 18D that the following magnets have to be energised: 114, 115, 116, 117 and 124. For this purpose one contact controlled by the key 0 is connected to the positive current supply line and the other five are each connected to one of the magnets named. In a similar manner, inspection of the tables of Figures 18A, 18B, 18C and 18D shows that when the key 1 is depressed the following magnets have to be energised: 100, 109, 113, 117 and 124, and it will be seen from Figure 24 that the key 1 controls six contacts one of which is connected to the positive current supply line and the other five to the five magnets last named. The remaining keys 2 to 9 inclusive control sets of contacts connected up to the magnets according to the same principle.

Figures 20A, 20B, 20C and 20D show one of the switches SA. Figure 20B is a continuation to the right of Figure 20A, these two figures completing the tens part of the switch, and Figure 20D is a continuation to the right of Figure 20C, these two figures together forming the units part of the switch. The switches SA are built up from a number of electromagnetically operated switch units in the manner already described for the switches SB, so that further description of this construction is considered unnecessary. The switches SA are closed by magnets 50 to 77 inclusive and opened by magnets 50' to 77' inclusive, and Figure 25 shows the connections of these magnets to the contacts operated by the keys 0 to 9 of one of the rows 223 of Figure 2. Each row of keys 223 controls an identical switch SA by means of a magnet system as shown in Figure 25.

Figure 23 shows one of the switches SD, which is composed of ten of the electromagnetically operated switch units each having eleven contact pairs. As shown by the table labelled "Switch D" one of these units is operated for each digit registered. The magnets for closing the switch contacts are shown below the table and are denoted by the references 130 to 139 inclusive. References 130' to 139' indicate the corresponding magnets for returning the switches to the open position. One lead of each of the magnets is connected to the negative current supply line, and the other lead of each of the opening magnets is connected to one contact of the contact pair 237 which is closed by the trigger 232 (Figure 4). The other contact of the pair 237, and one contact of each of the contact pairs closed by the keys 0 to 9 inclusive are connected to the positive current supply line. The other contact of each of the pairs controlled by the keys is connected to the closing magnet to be controlled by that key. The keys 0 to 9 are one of the rows of keys 225 shown in Figure 2. The other rows of keys control identical switches SD in the same manner.

It was previously pointed out that the method of multiplication can be indicated diagrammatically by assuming that one factor, with its digits in inverted order, is moved relatively to the other factor. Five positions in such a movement are shown in Figure 13. In each position each digit of the factor B is multiplied by the digit of a factor A to its left to obtain a units digit and by a digit of the factor A to its right to obtain a tens digit. Thus the first three stages of the operation are as follows:

Position 0, the product of the units digit b_0 of the factor B_0 by the units digit a_0 of the factor A is obtained and subtracted from the units digit d_0 of the factor D.

Position 1, the sum of the units digits of the product of b_0 and a_1, the tens digit of the product of b_0 and a_0 and the units digit of the product of b_1 and a_0 is subtracted from the digit d_1.

Position 2, the sum of the units digit of the product of a_2 and b_0, the tens digit of b_0 and a_1, the units digit of a_1 and b_1 and the tens digit of b_1 and a_0 is subtracted from the digit d_2 of factor D.

Figure 15 shows the order in which the switches are connected in circuit by a commutator presently to be described for the stage of the operation corresponding to position 0 in Figure 13. At this stage only the units parts U of the switches SA_0 and SB_0 and the switch SD_0 are connected in circuit. On the left-hand side the positive pole of a source of supply is connected to an arrival lead of the switch SA_0. The departure lines of the switch SD_0 are connected firstly to the decadal indicator UD of the units denomination of the result register and then to the hendecadal indicator UH of the units denomination. During the first part of this stage of the operation notation-controlling commutators to be described are in the decadal position while during the second part they are in the

hendecadal position. As will be clear from the following description the switches SA_0 and SB_0 will determine the units digit of the product of the units digits of the two factors and this units product digit will be subtracted from the units digit of the factor D by the switch SD_0.

This circuit will lead to one of the lines CR_0 to $9R_0$ of Figure 11B and as already explained the units decadal indicator UD will move to a position corresponding to the units digit of the result. In the second part of the first part of the operation the notation-controlling commutators will have shifted so that a similar circuit will be completed to energise the units hendecadal indicator UH in accordance with the units digit result in the hendecadal notation. The differential "carrying" switch DS_0 (Figure 16) operated by these two indicators will thus be adjusted in accordance with the difference between the units digits in the two notations, and will, as previously described, select one of a number of leads. These leads are permanently connected to the arrival leads of the switch SA_1, which is the first switch of the series of switches established to calculate the digit of the tens denomination of the result as shown in Figure 16. In this second stage in the operations, corresponding to position 1 of Figure 13, the series of switches comprises the units part of the switch SA_1, the switches SB_0 and SA_0, the units part of the switch SB_1 and the switch SD_1. Circuits are established through these switches, including the differential "carrying" switch DS_0 of the units denomination, to adjust first the tens decadal (TD) and then the tens hendecadal (TH) indicator.

The series of switches established in the third stage of the operation are shown in Figure 17 and are similar so that they need not be described. After a circuit has been completed through the highest switch SA provided in the machine (SA_2), a series of switches will be established in the next stage starting with a switch SB_0 and terminating with the switch SA_0 and one of the switches SD. The number of switches in sequence then progressively diminishes until in the final stage the sequence consists in the highest switch SB followed by the highest switch SA. In connection with the last sentence it should be noted that it is possible, for reasons which will be explained, to employ one fewer switch SD than there are denominations in the result; which accounts for the fact that the last sequence of switches consist of the highest switch SB and the highest switch SA only.

Figure 26 is a key diagram showing how Figures 18A to 23 inclusive may be pieced together to complete the electrical circuits corresponding to the five positions of Figure 13. In the position O only Figures 18A, 18B, 20C, 20D and 23 are involved and should be arranged in the order shown so that the circuits may be traced from one sheet to the next. This arrangement corresponds to Figure 15 except that the tens part of the switches SA_0 and SB_0, which are not involved in the circuits, have been omitted. The arrangements for positions 1 and 2 similarly correspond to Figures 16 and 17.

Before describing the circuits in detail, the principle on which a pair of switch parts operates will be described generally.

Taking first the case of the units part of a switch SA followed by the units part of a switch SB, these two switch parts have to add to a digit s, determined by the earlier switches in the sequence, the units digit of the product of the digit a which the switch SA is set to represent, and the digit b which the switch SB is set to represent. Using the hendecadal notation there are 11 possible values for s and 10 possible values for a and b. There are therefore 1,100 possible computations, but there are only 20 possible results, since the largest product digit is 9 and the largest value of s is 10, so that the possible results are 0–19 inclusive. There are 11 arrival leads to the units part of the switch *SA*, each of these leads corresponding to a different value of s. The appropriate lead is rendered alive by circuits completed from the earlier switches in the series while the other leads are dead. Each of these leads has 10 branches, each branch corresponding to a different value of a. The switch SA serves to make a connection in each branch corresponding to the definite value of a which the switch is set to register, there being one of such branches in each of the eleven sets. The switch also breaks the other branches corresponding to other values of a, so that a connection can be established through the arrival lead which is alive to the connected branch which is associated with the digit for which the switch SA is set. The 110 branches extend from the switch SA to the related switch SB. Each branch is provided with 10 secondary branches inside the switch SB, each of the secondary branches relating to each one of the primary branches being allocated to a different value of b. The switch SB is provided with contacts for completing connections in all the secondary branches corresponding to the value of b for which the switch is set, there being one of such branches in each of the 110 secondary sets. The switch SB interrupts the secondary branches corresponding to all other values of b. Since each secondary branch in a group corresponds to a different value of b, only one branch in a group will be alive and the secondary branch in the group will continue the circuit through the primary branch which is alive. This circuit will correspond to the computation $s+ab$ where s, a and b have definite values and will therefore have a definite result value depending upon the values of the factors. Each of the secondary branches is connected permanently to one of 20 result wires allocated to the different results from 0 to 19. If the calculation is proceeding on the decadal system, the result wires corresponding to 10–18 are connected respectively to the result wires corresponding to 0–8, since only the units digit of the result is required, so that the result 10 corresponds to the result 0 and so on. If the calculation is proceeding on the hendecadal notation the result wires corresponding to 11–19 are connected respectively to the result wires corresponding to 0–8 since the units digit of 11 when expressed in the hendecadal notation is 0 and the units digit of 12 is 1 and so on. A connection is thus completed from the arrival wire to one of 11 departure wires, which are the result wires corresponding to 0 to 10, corresponding to the required result. This departure wire is in turn connected to the arrival wire of the next switch part in the series which would normally be the tens part of the switch SB.

The connections for the tens switch part of SB followed by tens switch part SA will be substantially the same, but the manner in which the various secondary branches are connected to the result wires will be different, since the tens digit of the product must be taken into account instead of the units digit. Further, the switch SB

controls the contacts in the primary branches, while the switch SA controls the contacts in the secondary branches, since the switch SB precedes the switch SA in series at this point of the series of switches.

To summarize the above each switch SA would be connected to the units part of one switch SB by 110 primary branches from its units part and to the tens part of another switch SB by 110 primary branches from its tens part and thus would have 220 primary branches, that is connections to switches SB. Each switch SA would have also 11 arrival leads and 11 departure leads. Further each switch SA would have 110 contacts in its units parts and 1100 contacts in its tens parts or 1210 contacts in all. Each switch SB would also have 11 arrival and 11 departure leads 220 primary branches and 1210 contacts, 1100 in its units part and 110 in its tens part.

In practice it is possible, as will be described next, to modify the theoretical circuits described above so as to reduce the total number of contacts required in each switch. The effect of these modifications is to reduce the total number of contacts in each switch SA to 381, 253 in the tens part and 128 in the units part, and the number of contacts in the switch SB to 490, 352 in the units part and 133 in the tens part. It will be noted that the decrease in the number of contacts in one part of each switch is accompanied by an increase in the other part of that switch but the total number of contacts is greatly reduced. The number of primary branches is drastically reduced but the modifications necessitate additional connections between the switches which, with the remaining primary branches, result in a total of 199 connections from each switch to the preceding and following switch in the series.

The modifications will now be explained with reference to Figures 18A, 18B, 20C and 20D, which should be arranged as shown at position 0 in Figure 26, and show the circuits for the units part of the switch SB_0 and the units part of the switch SA_0. As already explained, the contacts shown in Figures 20C and 20D are in the switch SA_0, and the table labelled "Switch A" indicates the digital settings of the switch for which particular contacts will be closed. Similarly the contacts in Figures 18A, 18B are in the switch SB_0, and the table labelled "Switch B" shows which contacts are closed in any particular setting of the switch.

The arrival wires are shown at a and correspond to the digits 0–10 as indicated in the lower left-hand corner of Figure 20C. The departure wires are shown at i in the upper right-hand corner of Figure 18B, and the digital values corresponding to them are indicated.

If the digit a is zero, the units digit of the product ab is also zero, so that the arrival wires a can be connected directly to the corresponding departure wires i by means of the contacts i_0 to i_{10} which are closed when the switch SA_0 is set to record 0. Under these conditions, the contacts a'_0 to a'_{10} are also closed, so that the circuit may extend from the line a_0 to the line i_0 from the line a_1 to the line i_1 and so on. The primary and secondary branches for the value $a=0$ can thus be omitted.

When the value of a is 1, the switch SA_0 will close contacts k_0 to k_{10}, and the contacts a'_0 to a'_{10}, so that the circuits will extend over a group of lines k which constitute the primary branches. Each of these primary branches can be connected by 9 pairs of contacts to any one of 9 lines p_0 to p_{18}, the contacts being arranged systematically. The line k_0 corresponds to the computation $0+1x$, the line k_3 to the computation $3+1x$ and so on. Thus, the line k_0 must be connected to one of the result lines p_0 to p_8 which correspond to the results 1–9, the line k_3 must be connected to one of the lines p_3 to p_{11} which correspond to the results 4–12, and so on. Which of these various contacts are closed, as the result of the setting of the switch SB_0 that has been made, is indicated by the dashes in the table "Switch B," and the arrangement is such that each of the lines k_0 to k_{10} is connected to the appropriate one of the lines p_0 to p_{18}. Thus, when the switch SA_0 is set to register 1 and the switch SB_0 set to register a significant digit and with one of the leads a only alive, a unique circuit will be established through one of the lines a'''_0 to a'''_{10}, one of the lines k_0 to k_{10} and one of the lines p_0 to p_{18}. Similar primary branches comprising the lines m, l and n are provided for the digital values 2, 3 and 4 of a respectively. In connection with the branches m and n, a simplification is possible owing to the fact that the products of the digits 2 and 4 must have the values 2, 4, 6, 8 so that only four pairs of contacts are needed to connect each of the lines m and n to the appropriate lines p. Thus, the contacts which connect the line m_0 to the line p_1 to give the result 2 are closed both when the digital value of b is 1 and when it is 6, since the units digit of the product 2×1 and of the product 2×6 is 2 in both cases.

The manner in which circuits are established when the digit a is 6, 7, 8 or 9 is based upon the following considerations. If the units digit of a product ab is y, the units digit of the product $(10-a)b$ is $10-y$. The truth of this can be shown by the following demonstration. Let x be the tens digit of the product ab so that $ab=10x+y$ then $(10-a)b=10b-ab=10b-(10x+y)=10(b-x-1)+(10-y)$. Thus the tens digit of the product $(10-a)b$ is $(b-x-1)$ and the units digit is $10-y$. In other words the units digit of the product of two digits is the complement of the units digit of the product of the complement of one of those two digits multiplied by the other digit. Further, the sum of the complements of the two digits is equal to the difference between 20 and the sum of the two digits. Thus $(10-s)+(10-y)=20-(s+y)$.

The digit 9 is the complement of 1, the digit 8 is the complement of 2, the digit 7 is the complement of 3 and the digit 6 is the complement of 4. With the present circuits the same connections between the lines a''' and k are established both for 1 and 9. The lines 1 are connected to the lines a''' both for the digits 3 and 7. The lines m and n are used in the same manner for the digits 2 and 8 and for the digits 4 and 6 respectively.

Thus when the switch SA_0 is set to register 6, 7, 8 or 9, it will establish the same circuit connections from the lines a''' to the lines p as when it is set to register 4, 3, 2 or 1 respectively and these connections will serve to complete a circuit corresponding to the complement of the units digit of the product instead of that corresponding to the units digit of the product. Further when the switch SA_0 is set to represent 6, 7, 8 or 9, it will close the contacts a'' and connect the lines a to the lines a''' in inverted order so that the line a''' which is alive corresponds to the complement of the digit represented by the line a which is

alive. Thus the complement of the digit s will be added to the complement of the units digit y of the result and the line p which is alive will correspond to the difference between 20 and the required result digit.

The lines p are connected to the departure lines i by means of two groups of contacts p of the switch SA_0. The left-hand group of contacts p_0 to p_8 are closed when the switch SA is set to record 1, 2, 3 or 4 and serve to connect the lines p_0 to p_8 to the lines i_1 to i_9 respectively. The lines p_0 to p_8 correspond to the digits 1 to 9 of the result and are therefore connected directly to the required lines i. The line p_9 which corresponds to 10 is permanently connected to the line i_{10} since the result 10 is always equal to 10 whether it is the true number or the complement of the true number.

When the result is a complement, the line p_{18}, will correspond to the complementary result 19 and therefore to the true result 20—19=1. The contacts p_{18} of the righthand group p_{10} to p_{18} serve therefore to connect the line p_{18} to the line i_1. This right-hand group of contacts p_{10} to p_{18} is closed when the switch SA_0 is set for 6, 7, 8 or 9. The other lines p_{10} to p_{17} are similarly connected so that the complementary result represented by the energised line p_{10} to p_{18} is converted into a true result represented by an energised line i_1 to i_{10}.

The above is explained as to how the units digit required is arrived at when the sum $(s+ab)$ is 10 or less. If the sum is more than 10 and is a true amount, one of the lines p_{10} to p_{18} will be alive and this line must be connected to the appropriate line p_0 to p_8 so as to complete the circuit through the proper departure line i_1 to i_9. For this purpose a commutator is provided which is shown to the right of the lines p in Figure 20D and comprises a plurality of segments designated 0 to 8 and 10 to 18 connected each to the corresponding line p_0 to p_8 and p_{10} to p_{18} and two rows of bridging contacts labelled "base 10" and "base 11". The bridging contacts labelled "base 10" bridge the contacts when the calculation is proceeding on the decadal notation and serve to connect the line p_{10} corresponding to the result 11 to the line p_0 corresponding to the result 1 and so on. When the calculation is proceeding on the hendecadal notation the bridging contacts labelled "base 11" bridge the contacts 0 to 18 and connect the line p_{11} corresponding to 12 to the line p_0 corresponding to 1 and so on. Thus the result computed by the switch parts SA_0 and SB_0 under consideration will be expressed in the decadal or the hendecadal notation and carried forward to the next pair of switch parts. The same commutator serves to make the proper connections when the result is a complement of a sum more than 10 but in this case the connections will arrive through one of the lines p_0 to p_8 and will leave through one of the lines p_{10} to p_{18} instead of vice versa. It will be appreciated that only one of these two groups of lines p can be connected to the group of lines i so that only one circuit can be completed.

In the above description it was assumed that the digit b was a significant digit. If the digit b is 0 the setting of the switch SB_0 causes the contacts k, l, m and n opposite the left-hand part of the table headed Switch B to be closed so as to connect whichever of the lines k, l, m or n, that is alive to a line q. The effect of this connection is that when the digit a is not 0, each arrival line a is connected to the line q for the same digit. If the digit a is 1, 2, 3 or 4, the left-hand group of contacts q_0 to q_{10} of the switch SA_0 will be closed and will connect the lines q_0 to q_{10} each to the corresponding line i_0 to i_{10} so that each line a will be connected to the corresponding line i, which is correct since the product ab is zero. If the digit a is 6, 7, 8 or 9, the setting of the switch SA_0 will connect the lines a to the lines a''' in inverted order so that the lines a will be connected to the lines q in inverted order also. In view of this the switch SA_0 is arranged to close the right-hand group of contacts q_0 to q_{10} when the digit a is 6, 7, 8 or 9 so as to invert the connections between the lines q and the lines i and correct inversion between the lines a and the lines a'''.

If the digit a is even and the digit b is 5, their units product is necessarily zero. The switch SB_0 is therefore arranged to close the contacts m_0 to m_{10} and n_0 to n_{10} when it is set to record 5. Since one or other of the two groups of lines m and n is included in the circuit when the digit a is even, this will have the result of connecting lines a to the lines q whenever the digit a is even and the digit b is 5. The case where the digit a is odd and the digit b is 5 is taken care of by the contacts k and l of the switch SB_0 in the manner previously described.

Finally, when the digit a is 5 the units digit of the product will be 0 if the digit b is even and 5 if the digit b is odd. When the switch SA_0 is set for 5 it closes the contacts O_0 to O_{10} to establish circuit through a group of lines O which can be connected to the lines p in the proper manner on the closure in Figure 18A of a group of contacts O_0 to O_{10} of the switch SB_0. These contacts are closed whenever the digit b is odd. It will be noted that the contacts a'' are closed when the switch SA_0 is set for 5 so that the result obtained is a complementary result. It is therefore converted into the true result in the same way as when the digit a is 6, 7, 8 or 9. When the digit b is even, a group of contacts O_0 to O_{10} of the switch SB_0 (Figure 18B) is closed and serve to connect the lines O_0 to O_{10} to the lines i_0 to i_{10} in the proper manner, allowance being made for the fact that the contacts a'' are closed so that each line a is connected to the corresponding line i.

The construction of all the switches SA is the same and the construction of all the switches SB is the same, so that the explanation just given in connection with Figures 18A, 18B, 20C and 20D serves also for the co-operation of the units parts of the switches SA_1, SB_0 and SA_0, SB_1 which occur in position 1 and involve Figures 18A, 18B, 21C, 21D and 19A, 19B, 20C and 20D respectively, for the co-operation of the units parts of the switches SA_2, SB_0 and SA_1, SB_1 which occur in position 2 and involve Figures 18A, 18B, 22C, 22D and 19A, 19B, 21C and 21D respectively, and for the cooperation of the units parts of the switches SA_2, SB_1 which occurs in position 3 and involves Figures 19A, 19B, 22C and 22D. In other words, Figures 18A and 19A are identical as are also Figures 18B and 19B; 20C, 21C and 22C; 20D, 21D and 22D.

Turning now to the case when the tens part of a switch SB is followed by the tens part of a switch SA, and taking as an example the co-operation of the tens part of the switch SB_0 with the tens part of the switch SA_0, which occurs in position 1 and involves Figures 18C, 18D, 20A and 20B arranged in the order shown in Figure 26, position 1, the current will arrive by a wire i (Figure 18C) of the switch SB_0 and depart by a wire a

of the switch SA_0. If the digit b is 0 or 1, the tens digit of the product ab will necessarily be 0 and therefore the sum of the tens digit of the product ab and the digit s introduced through the wire i will be equal to the digit s. Thus the switch SB_0 is arranged to close its contacts a_0 to a_{10} when it is set to represent 0 or 1 and to connect the lines i directly to the lines a in the normal order.

When the digit b is 2, 3 or 4 the switch SB_0 will connect the lines i to groups of lines d, e, or f respectively. The switch SA_0 will connect the appropriate group of lines d, e or f to lines c of which there are 14. These lines return to the switch SB_0 and are connected by the switch SB_0 to lines a_0 to a_{13} by the contacts c_0 to c_{13}. These lines correspond to the results from 0 to 13 in value and the lines a_{10} to a_{13} are connected, in accordance with the hendecadal or the decadal notation and by the commutator indicated below them, to the lines a_0 to a_3 in the same manner as was previously described with reference to Figures 18A, 18B, 20C and 20D. The circuits are similar to those described with reference to Figures 18A, 18B, 20C and 20D for the digits 1 to 4 except that they are arranged to effect the addition of the tens digit of the product to the digit introduced from the earlier switches instead of units digit of the product.

When the digit b is 5, the switch SB_0 connects the lines i to lines g which are connected by the switch SA_0 to lines a_0 to a_{14} in the appropriate manner and these lines are connected to the departure lines a_0 to a_{10} through the notation-changing commutator or directly in the manner described previously. If the switch SB_0 is set for 9, the contacts i'' will be closed instead of contacts i' and the lines i will be connected in the switch in the complementary manner instead of the direct manner. The switch SB_0 will also close its contacts h_0 to h_{10} so as to connect the lines h to the lines i and the lines h will be systematically connected to the lines a_0 to a_{18} in accordance with the values of the tens digits of the various products but the connections will be so made as to allow for the fact that the lines i are connected in a complementary manner. For example, the line h_0 which is connected to the line i_{10} will be connected to the line a_{10} and not the line a_0 when the switch SA_0 is set for 0. The contacts h of the switch SA_0 are arranged to give the complement of the tens digit and this digit is added to the complement of the digit introduced by the lines i; the complementary is then reconverted back to its proper form.

The circuits established when the digit b is 6, 7 or 8 are based upon the following considerations. If b_1 and b_2 are complementary digits, x is the tens digit of the product $b_1 \times a_1$, y is the tens digit of the product $b_2 \times a_1$ and z is the tens digit of the product $9a_1$ then $x+y=z$. For example, if 2 and 8 are the complementary digits b_1 and b_2 and a_1 is 7; x will equal 1, since twice 7 is 14; y will equal 5, since $8 \times 7=56$; z will equal 6, since $9 \times 7=63$. $1+5=6$. When the digit b is 6, 7 or 8, the contacts i'' of the switch SB_0 are closed so that the circuit established will correspond to s where s is the digit corresponding to the energised line i. In addition the circuit will include one of the lines d, e or f corresponding to the complement of the digit which the switch SB_0 is set to represent. Thus, if the switch SB_0 is set to represent b_1 and the switch SA_0 is set to represent a_1, the circuit established will correspond to a_1, b_2 where b_2 is the complement of b_1. The required result is $s+x$ but the circuits established will correspond to $-s+y$. The circuit will include the lines c_0 and c_{13} which are connected by the row of contacts h of the switch SB_0 (Figure 18D). This row of contacts h are closed when the switch is set to record 6, 7 or 8. The circuits continue in exactly the same way as when the switch SB_0 was set to represent 9 except that instead of the line corresponding to the complement of s, or to $-s$, being rendered alive by being connected to the alive line i, the line h corresponding to $(-s+y)$ is rendered alive by being connected to the alive line c. As previously explained the contacts h of the switch SA_0 serve to select the lines corresponding to the complement of the tens digit of 9 times the digit for which the switch SA_0 is set. Since the switch SA_0 is set to represent the digit a_1 the circuit completed will correspond to $(-s+y-z)$ where z is the tens digit of the product $9a_1$ as before. Now $y-z=-x$ so that the connection corresponds to $-s-x$ or $-(s+x)$. As previously explained the contacts h of the switch SA_0 correct for the fact that the result is in a complementary form so that the circuit selected is the correct one namely that corresponding to $(s+x)$.

Finally, when the switch SA_0 is set to register 5, special circuits are completed when the switch SB_0 is set for 6, 7, 8 or 9. These circuits are completed through the group of wires b and need no special explanation.

The explanation just given in connection with Figures 18C, 18D, 20A and 20B serves also for the cooperation of the tens parts of the switch SB_0, SA_1 and SB_1, SA_0 which occur in position **2** and involves Figures 18C, 18D, 21A, 21B and 19C, 19D, 20A and 20B respectively, for the co-operation of the tens parts of the switches SB_0, SA_2 and SB_1, SA_1 which occur in position **3** and involve Figures 18C, 18D, 22A, 22B and 19C, 19D, 21A and 21B respectively, and for the co-operation of the tens parts of the switches SB_1, SA_2 which occurs in position **4** and involves Figures 19C, 19D, 22A and 22B. In other words, Figures 18C and 19C are identical as are also Figures 18D, 19D; 20A, 21A and 22A; 20B, 21B and 22B.

A complete connection table for the switches SA is shown in Figure 27 while Figure 28 is a similar table for the switches SB. In these tables each lead is designated by a letter which is shown to the left of the table and a figure. It will be noted that the tables are divided into groups and connections are made by the switch between the leads occurring in a vertical column in each group of the table but not between the leads in two different groups of the table. Whether or not a connection is made between a pair of leads occurring in the same table depends upon the setting of the switch and is indicated by the dashes in the left-hand part of the table. This part of the table is divided into ten vertical columns corresponding to the ten possible positions of the switch. If a dash occurs in a column opposite a horizontal line of leads in the right-hand part, a connection can be made to any of those leads. Two leads occurring in a vertical column will be connected together in a particular setting of the switch if dashes occur opposite both those leads in the column corresponding to that setting of the switch. For example, in position **3** of the switch SA, the leads c_0, d_0 and e_0 (Figure 4) are connected together, the leads c_1, d_1, e_1 and f_0 are connected together, the leads c_2, d_2, e_2 and f_1 are connected together and so on. In position **4**, on the other hand, the leads c_0 and d_0 will be connected together, the leads c_1, d_1, e_0 and f_0

will be connected together and so on. It will be noted that many of the leads are duplicated. This is of course merely diagrammatic in order that the connections established in the various positions may be made apparent. For example, the leads e_0 to e_{10} are shown 3 times. This is because in the positions 0, 1, 2, and 3 they have to be connected respectively to the lines c_0 to c_{10}, in the positions 4, 5 and 6, they have to be connected to the lines c_1 to c_{11}, and in the positions 6, 7, 8 and 9, they have to be connected to the lines c_2 to c_{12}. These three different schemes of connections have been shown by repeating the line three times in different relative positions to the lines c and by providing dashes in the appropriate columns to the left of the table.

One method of materialising these tables will be explained as applied to group 1 of Figure 27. In this method each designation comprising the letter d, e or f and a number shown in the table denotes a pair of contacts connected between the line having the same designation and the line c_0 to c_{13} at the head of the column containing the designation. Thus, there are two sets of eleven contacts d_0 to d_{10}. One set connects the line d_0 to the line c_0 and so on, and the other the line d_0 to line c_1 and so on. The first set are closed for the positions 0 to 4 of the switch and the second set for the positions 5 to 10. In the same way there are three groups of contacts e_0 to e_{10} and four groups of contacts f_0 to f_{10}. This is the method of showing the contacts adopted in Figures 18A to 22D inclusive but is not the only method or necessarily the best method.

The system of connections shown in Figures 27 and 28 produce exactly the same results as those shown in Figures 18A to 22D inclusive but are not absolutely identical. The principal difference is that in Figures 18A to 22D the contacts a' and a'' are provided for the purpose of obtaining the complement of the digit introduced whereas in Figure 27 the same result is obtained by providing two alternative methods of connection between the lines a and k, a and l, a and m, a and n. One of these methods of connection is a direct method and the other is an inverted method. The effect of the connections shown in Figure 27 is that instead of providing the contacts a' and a'' there will be provided duplicate contacts k, l, m and n for connecting the corresponding wires to the wires in an inverted manner instead of a direct manner. It will be noted that the arrangements shown in Figure 20C result in an economy since only two sets of contacts are required instead of four. In a similar manner the contacts i and i' of Figure 18C replace the alternative connections d, e, and f shown in Figure 28.

The 98 leads of each switch SA denoted in Figure 27 by the reference letters a to h, excluding the leads a_{14} to a_{18} which are internal leads, are connected to the correspondingly lettered leads of the switch SB as shown in Figure 28. The 101 leads of the same switch SA denoted in Figure 27 by the reference letters i to q, but excluding the leads i_{16} to i_{19} which are internal leads, are connected to the corresponding lettered leads of another switch SB. These connections are effected by means of a commutator so as to connect the switches together in a different ordered series at each stage of the calculation. The arrangement of this commutator, shown at 29 in Figure 11A, will be described later.

The wiring for each of the switches SD is shown in Figure 23. The switch receives current from the line a or the line i which is alive and corresponds to the units digit of the sum of all the units and tens product digits which are summed at a particular stage of the computation. The function of the switch SD is to subtract this digit from the digit which is registered by the setting of the switch. The switch closes a group of eleven contacts in each of its positions so as to connect each line a or i to one of ten lines c_0 to c_{10} corresponding to the difference between the two digits if the digit recorded by the switch SD is the larger. For example, if the switch is set to record 5 and the alive line a or i represents 3, the circuit will be completed through the line labelled a_3 or i_3, the diagonal line labelled 3 and the line c_2. If the digit represented by the switch SD is the smaller, it is necessary to subtract the digit represented by the line a or i from ten plus the digit represented by the setting of the switch if the calculation is proceeding on the decadal notation and from eleven plus the digit represented by the setting of the switch if the calculation is proceeding on the hendecadal notation. There are thus two possible values of the result digit under the latter condition and the circuit continues from the line a or i through one of the lines c_{10} to c_{19} and hence through the notation-controlling commutator and either through the segments marked base 10 or the segments marked base 11 to the lines c_0 to c_9. For example, if the switch SD is set for 5 and the digit to be subtracted is 7 the circuit will include the line a_7, the diagonal line labelled 7, the line c_{11} and then either the line c_8 or the line c_9. The first case corresponds 10+5−7 on the decadal notation and the second case to 11+5−7 on the hendecadal notation.

The connection table for the switches SD is shown in Figure 29. The switches SD are connected as follows. The leads i_0 to i_{10} of the switch SD_0 (Figure 11A) are permanently connected respectively to the corresponding leads i_0 to i_{10} of the switches SB_0. The switch SD_1 is connected in the same way to the switch SB_1 and so on up to the switch SD_n, the switch SB_n being the switch for the highest denomination of the factor B. The leads a_0 to a_{10} of the switch $SD_{(n+1)}$ are permanently connected to the corresponding leads of the switch SA_0, the switch $SD_{(n+2)}$ is connected to the switch SA_1 and so on.

As already explained, Figure 26 is a key diagram showing the order in which Figures 18A to 23 inclusive are arranged to enable circuits to be traced through in the five positions 0 to 4, and the circuits established by the switches for a numerical example 7538−(48×62)=4562 will now be indicated:

Position 0a (decadal notation)

Current enters 20C by a_0, a'''_{10}, m_{10} (SA_0=8) to 18A, p_{13} (SB=2) through 18B to 20D, i_6 (SA_0=8) through 18B to 23, c_2 (SD_0=8), result -- 2

Position 0b (hendecadal notation)

The circuit in this position is unchanged, result -- 2

Position 1a

Current enters 21C by a_0, n_0 (SA_0=4) to 18A, p_7 (SB_0=2) through 18B to 21D, i_8 (SA_1=4) through 18B to 18C, d_3 (SB_0=2) to 20A, c_9 (SA_0=8) through 20B to 18D, a_9 (SB_0=2) through 20B to 20C, a'''_1, m_1 (SA_0=8) to 19A, p_2 (SB_1=6) to 20D through notation-changing commutator to p_{12}, i_7 (SA_0=8) through 19B to 23, c_{13} (SD_1=3) through notation-changing commutator to c_6, result--- 6

Position 1b

The circuit in this position is the same as for position **1***a* up to the first notation-changing commutator (on Figure 20D) which makes a connection to p_{13}, i_6 (SA$_0$=8) through **19B** to **23**, c_{12} (SD$_1$=3) through notation-changing commutator to c_8, result ---------------- 8

Position 2a

Current enters **22C** by a_2, a'''_2, i_2 (SA$_2$=0) through **22D** and **18B** to **18C**, d_2 (SB$_0$=2) to **21A**, C$_2$ (SA$_1$=4) through **21B** to **18D**, a_2 (SB$_0$=2) through **21B** to **21C** a'''_2, n_2 (SA$_1$=4) to **19A**, p_5 (SB$_1$=6) through **19B** to **21D**, i_6 (SA$_1$=4) through **19B** to **19C**, f_4 (SB$_1$=6) to **20A**, c_7 (SA$_0$=8) through **20B** to **19D**, h_7 (SB$_1$=6) through **19C** and **19D** to **20B**, a_{10} (SA$_0$=8) to **23**, c_{14} (SD$_2$=5) through notation-changing commutator to c_5, result -- 5

Position 2b

The circuit in this position is the same as for position **2***a* up to the notation-changing commutator in Figure 23 which makes a connection to c_6, result ------------------------------- 6

Position 3a

Current enters **18C** by i_1, d_1 (SB$_0$=2) to **22A**, c_1 (SA$_2$=0) through **22B** to **18D**, a_1 (SB$_0$=2) through **22B** to **22C**, a'''_1 (SA$_2$=0) to **22D**, i_1 (SA$_2$=0) through **19B** to **19C**, f_9 (SB$_1$=6) to **21A**, c_{10}, (SA$_1$=4) to **19D**, h_{10} (SB$_1$=6) through **19C** and **19D** to **21B**, a_3 (SA$_1$=4) to **23**, c_4 (SD$_3$=7), result ----------------------- 4

Position 3b

The circuit in this position is the same as for position **3***a*, result ---------------------------- 4

Position 4 (decadal only)

Current enters **19C** by i_0, f_0 (SB$_1$=6) to **22A**, c_0 (SA$_2$=0) through **22B** to **19D**, h_0 (SB$_1$=6) through **19C** and **19D** to **22B**, a_{10} (SA$_2$=0) through notation-changing commutator to a_0, result ------------------------------------- 0

The commutator **209** (Figure 1) which controls the various connections in accordance with the stage of the operation rotates continuously through a quarter revolution for each calculation to perform the following functions:

(1) To establish the different series of switches appropriate to each stage of the calculation in turn by connecting the various leads of each switch to the corresponding leads of two other switches on either side of it in the series.

(2) For the first stage it must connect the lead a_0 of the switch SA$_0$ to the source of current, and for the succeeding stages it must connect the single contact **20** (Figure 11A) of the appropriate differential switch DS$_0$, DS$_1$, DS$_2$ or DS$_3$ to the source of current.

(3) At each stage of the operations it must adjust the circuits first to give the result on the decadal notation and then on the hendecadal notation.

(4) Finally, it must connect the departure lines C$_0$ to C$_{10}$ of each switch SD$_0$, SD$_1$ etc. to the corresponding leads of the two indicators for the corresponding denomination of the result register and these connections must first be made to the leads of the decadal indicator and then to the leads of the hendecadal indicator.

All these functions are carried out by the single complex commutator **209**, but to enable the operation to be more readily followed the commutator has been divided into parts in the diagram of Figures 11A and 11B.

The commutator part **26** for carrying out the function (2) has already been described with reference to Figure 1, and commutators for carrying out the function (3) have been referred to in connection with Figures 18A to 23 inclusive. On Figures 11A and 11B all the commutators are shown diagrammatically and these figures will now be further explained.

On the right hand side of Figure 11B are the indicators of the result register which, as already described, co-operate in pairs to actuate the differential switches DS$_0$ to DS$_3$ shown on the left hand side of Figure 11A. These differential switches co-operate with the commutator **26** in the upper left hand corner of Figure 11A to connect the positive pole of the source of current to the appropriate input lead of the first switch of each series. The switches SA$_0$, SA$_1$ and SA$_2$ are grouped together at the bottom of Figure 11A and are each represented by two rectangles, for the units and tens parts respectively, joined by an arrival line a_0. These lines a_0 are selected as typical of the eleven arrival lines a_0 to a_{10} of the switches SA. In a similar manner the switches SB$_0$ and SB$_1$ are represented at the top of Figure 11A by pairs of rectangles joined by typical arrival lines i_0.

The switches SD$_0$, SD$_1$, SD$_2$ and SD$_3$ are shown as rectangles arranged in a vertical group in the upper right hand corner of Figure 11A. In the first stage of the operations the switch SB$_0$ is followed by the switch SD$_0$ (see Figure 15) and this is indicated by the typical line i_0 connecting the switch SB$_0$ to the switch SD$_0$. In the second stage of the operations the switch SB$_1$ is followed by the switch SD$_1$ (see Figure 16) and this is indicated by the typical line i_0 connecting the switch SB$_1$ to the switch SD$_1$. Similarly, in the third and fourth stages the switches SA$_0$ and SA$_1$ are followed by the switches SD$_2$ and SD$_3$ respectively, and the connections are indicated by the typical lines a_0. As already explained, for the fifth stage no switch SD is required, and the typical line a_0 from the switch SA$_2$ is therefore shown proceeding direct to the upper part of the commutator **27** which connects this line and the typical lines C$_0$ from the switches SD alternately to the appropriate result lines OR$_0$, OR$_1$, OR$_2$, OR$_3$ and OR$_4$ of the decadal result indicators and to the appropriate result lines OR'$_0$, OR'$_1$, OR'$_2$ and OR'$_3$ of the hendecadal result indicators. The lines C$_1$ to C$_{10}$ and a_1 to a_{10} from the switches SD and SA$_2$ proceed in a similar manner to the commutator **27** but are not completely shown. The lines C$_1$ to C$_8$ and a_1 to a_8 are omitted entirely, but the commutator ends of the lines a_9, C$_9$, a_{10} and C$_{10}$ are shown.

In the first part of the first stage of the operations the commutator **27** is in the position shown in Figure 11B and connects the lines C$_0$ to C$_9$ from the switch SD$_0$ to the result lines OR$_0$ to 9R$_0$ of the units decadal indicator UD in the manner shown for the lines C$_0$ and OR$_0$. Of these connections only the first indicated by a heavy line, and last are shown. For the second part of the first stage the commutator **27** is advanced one step in the direction of the arrow and then connects the lines C$_0$ to C$_{10}$ from the switch SD$_0$ to the result lines OR'$_0$ to **10**R'$_0$ of the units hendecadal indicator UH. Of these connections only the first and the last two are

shown. For effecting each of these connections a similar set of contacts has been shown on the commutator 27, but it will appreciated that as the lines a_{10} and C_{10} have only to be connected to the hendecadal indicators, some of the contacts of the corresponding part of the commutator arc redundant and could be omitted. For the first part of the second stage the commutator is advanced a further step and then connects the lines C_0 to C_9 from the switch SD_1 to the result lines OR_1 to $9R_1$ of the tens decadal indicator TD. The second part of the second stage and the subsequent stages follow in a similar manner, and it need only be pointed out that the last stage comprises only one part, in which the lines a_0 to a_9 from the switch SA_2 are connected to the result lines OR_4 to $9R_4$ of the ten thousands decadal indicator TTD.

At 28 is indicated the notation-changing commutator pertaining to the switches SD. Only part of this commutator is shown, but it will be understood that for each switch SD there is a pair of horizontal rows of contacts serving to connect the lines C_{10} to C_{19} leaving the switch to the lines C_0 to C_9 in the manner explained in connection with Figure 23.

In the first stage of the operations the units part U of the switch SA_0 has to be connected to the units part U of the switch SB_0 (see Figure 15), and this is effected by means of the commutator 29. A typical lead i_0 is shown in heavy lines leaving the units part of the switch SA_0, passing across the commutator and joining the lead i_0 of the units part of the switch SB_0. A similar connection can also be traced between the leads p_0 of these two switches. The same connections are maintained during both parts (decadal and hendecadal) of the first stage, and in order that all the commutator parts may be arranged on a common cylinder, the contacts of the commutator 29 are made sufficiently long so that a change of connection takes place only on every other step. For the second stage, therefore, the commutator 29 advances two steps in the direction of the vertical arrow and then connects the typical lines i_0 and p_0 leaving the units part of the switch SA_1 to the lines i_0 and p_0 of the units part of the switch SB_0, also the typical lines c_0 and a_0 leaving the tens part of the switch SB_0 to the lines c_0 and a_0 of the tens part of the switch SA_0, and also the typical lines i_0 and p_0 leaving the units part of the switch SA_0 to the lines i_0 and p_0 of the units part of the switch SB_1. These connections correspond to the series of switches shown in Figure 16. For the third stage the commutator moves a further two steps and then connects the switches in a similar manner in the order shown in Figure 17. In order to simplify the diagram only two typical lines have been shown between the switches, but it will be understood that by providing a suitable number of contacts on the commutator the remaining 99 lines connecting the units parts of the switches and the remaining 96 lines connecting the tens parts of the switches may be commutated in the same way. It will be noted in this connection that the lines from each switch run in pairs to adjacent brushes on the commutator, each pair comprising a line from the tens part and a line from the units part. Thus the lines p_0 and c_0 and i_0 and a_0 are paired.

The notation-changing commutators shown separately in the group of Figures 18A to 22D are shown as the single commutator 30 in Figure 11A. Like the commutator 28, this commutator comprises pairs of horizontal rows of contacts and rows of brushes contacting with every alternate row of contacts. The first row of brushes comprises a set connected to the lines p_0 to p_{18} leaving the units part of the switch SA_0, in the manner shown in Figure 20D, and a set connected to the lines a_0 to a_{18} leaving the tens part of the switch SA_0, in the manner shown in Figure 20B. Of the first set, only the brushes p_1, p_{11}, p_0 and p_{10} have been shown in Figure 11A, and only the connection of p_0 is shown completed, and of the second set only the brushes a_1, a_{11}, a_0 and a_{10} have been shown, and only the connection of a_0 is shown completed. In a similar manner the second and third rows of brushes comprise sets connected to the lines leaving the units and tens parts of the switches SA_1 and SA_2.

In Figures 11A and 11B the heavy line indicates a typical circuit which may be set up during the first part of the first stage (units decadal) of the operations. This circuit will be completed if the switches SA_0, SB_0 and SD_0 were all set at zero and gives the result zero. The circuit established during the hendecadal part of this stage would be the same except that the part of it to the right of the commutator 27 would follow the heavy dotted line instead of the heavy full line and would thus extend through the units hendecadal result register UH. This change is brought about by the movement of the commutator 27 through one step. The other commutators also move but make no alterations in the circuits.

Figures 12A and 12B are identical with Figures 11A and 11B except that the commutators have been moved through three steps to the tens hendecadal position. On these Figures a typical circuit has been indicated on the heavy line, the arrows on this line indicating the direction in which current flows from the positive to the negative pole. This circuit would be established if the switch DS_0 were at zero, there being no transfer from the preceding stage, and if all the switches SA_0, SA_1, SB_0, SB_1, and SD_1 were set at zero. The circuit extends through the differential switch SD_0, the units part of the switch SA_1, the units part of the switch SB_0, the tens part of the switch SB_0, the tens part of the switch SA_0, the units part of the switch SA_0, the units part of the switch SB_1, the switch SD_1 and hence through the commutator 27 to the tens hendecadal indicator TH. It will be nited that this circuit does not actually extend through the units part of the switch SB_1. This is because, as explained previously, the adjustment of the switch SB_1 has no effect on the result required if the switch SA_1 is set for 0 so that the switch SA_1 connects its arrival wire a_0 to its departure wire i_0 which is connected directly through to the wire i_0 of the switch SB_1 and the latter wire i_0 is conneced directly to the switch SD_1.

It will be appreciated that the above circuit would only be established for the particular setting of the switches mentioned. If there had been a transfer from the preceding stage of the operations, the switch DS_0 would have been in a different position and the circuit would have included a different one of the arrival wires a_0 to a_{10} of the switch SA_0. Further, if the other switches had been set for significant digits, the circuit would have passed over different connections between the switches to those shown in heavy lines.

Similar connections between the switches SA and SB may be traced on Figures 12A and 12B through the leads p_0 and c_0 of the switches and

it will be noted that all these connections extend through the upper group of eight segments of the commutator 29 while the connections through the leads a_0 and i_0 extend through the lower group of eight segments of this commutator. Thus, the part of the commutator shown serves to make connections between four leads from each switch and the groups of segments will be repeated so as to deal with all the leads from each switch, each group of segments dealing with two lines from each switch. It is of no importance which two lines from the switch are related to a particular group of segments provided that one of such pair of lines is connected to the tens part of the switch and the other is connected to the units part. Each group of segments will, of course, be related to the corresponding pairs of lines from all the switches SA and SB.

The commutator is constructed in the usual manner as a rotatable cylinder of insulating material having conducting segments inset in it. The segments are disposed and connected together as shown in Figures 11A and 11B. Each lead extending to the commutator terminates in a brush bearing on the surface of the cylinder so that a circuit can be completed through it if it engages a conducting segment. The circuit through this lead will be interrupted if its brush rests on the insulating portion of the commutator. While the commutator 29 has been shown in Figures 11A and 11B as extending only in the peripheral direction, it will be understood that a number of such contact groups are as shown in Figure 1 in order to avoid the use of a commutator of unnecessarily large diameter. Actually, for the commutator 29 there are spaced round the commutation cylinder 209 in the peripheral direction four sets of eight contacts interconnected as shown in Figure 11A, the sets being separated by two blank spaces, and in the longitudinal direction of the commutator this arrangement is repeated twenty-five times. The contact groups pertaining to the commutators 26, 27, 28 and 30 are also of course repeated four times round the periphery of the cylinder 209.

The arrangement of the commutator 29 is shown more generally in the connection table shown in Figures 30, 31A and 31B.

Figure 30 shows the manner in which the lines a_0 and i_0 of the five switches SA' and SB' are connected together at each stage in the operation. This figure only shows the connection for one of the 98 or 101 leads between each pair of switches but the connections for the other leads will be strictly analogous. At each stage in the operation the leads, which are indicated by the same sign in Figure 30, must be connected together for this stage. For example, for position 2b, the lead SA_2i_0 is connected to the lead SB_0i_0, the lead SA_1a_0 is connected to the lead SB_0a_0, the lead SA_1i_0 is connected to the lead SB_1i_0 and the lead SA_0a_0 is connected to the lead SB_1a_0. Figures 31A and 31B give an extension of this table for the lead $a0$ to $a4$ and $i0$ to $i4$ of the five switches. Each column of Figure 31A corresponds to a brush connected to the lead (of the switches SA_0, SA_1, SA_2, SB_0 and SB_1) indicated at the head of the column. The letters a, b, c etc., correspond to the different contact segments. The top line marked position 0 indicates the position of the various contacts relatively to the brushes for the position 0 and the successive lower lines indicate how the contacts move relatively to the brushes as the commutator is rotated. In other words each letter corresponds to a single contact in Figure 31A and the repetition of the letter merely shows the various positions which those contacts assume as the commutator rotates.

Figure 31B shows the position of the relative brushes and contacts associated with other leads of the switches SA_0, SA_1, SA_2, SB_0 and SB_1 for the various positions of the commutator and it will be appreciated that each contact which is indicated by a letter in Figure 31A is connected to the contact indicated by the same letter in Figure 31B, i. e. the contact a (Figure 31A) is connected with the contact a in Figure 31B.

It will be appreciated that the switches SA, SB and SD are set initially by means of the keys 223, 224 and 225 (Figure 2). Then as the commutator is rotated, upon operating the motor switch 238, it will establish all the proper connections between the various switches and the result register in the proper sequence. As each system of connections is established a unique circuit will be completed through the contacts and the proper denomination of the result register and a pulse of current will pass which will adjust the appropriate result indicating device. The commutator can be thus turned at a relatively high speed.

It will be appreciated that the switches SD could equally well be connected to perform addition as subtraction (e. g. by reversing the digits on the index by which each switch SD is set) so that the machine can be made to evaluate an expression in the form of D+AB instead of D—AB. The reason for arranging the switches SD_2 so that the expression D—AB is evaluated is that it enables division to be performed. For division the dividend is set up by the switches SD as the factor D and the divisor is set up as the factor A. The required quotient is to be the factor B. The value of B is found by a process of trial and error. For this purpose a suitable value for the quotient is decided on by inspection and is set up by means of the switches SB. The machine is then operated and determines a remainder R which is the difference between the dividend and the product of the divisor and the estimated quotient. If the quotient is too large this result will be negative and the fact that it is negative will be rendered evident by the fact that the highest denomination of the result register will contain a significant digit instead of zero. This denomination is in fact only used for this purpose so that there is no point in providing a corresponding switch SD. If the result is correct the remainder must be positive and it can be determined from inspection whether this remainder is greater than the divisor, in which case the quotient digit is too small, or is less than the divisor or zero, in which case the quotient is correct. If the quotient is not correct it is modified by adjusting the switches SB and further trials are made until the correct quotient is obtained.

In order to effect multiplication, the switches SD are set at 0. The result obtained is the complement of the true result and provision may be made for converting this complementary result into the true result by reversing the connections between the induction windings and the resistances W of the indicating mechanism. It is also possible to calculate an expression of the form AB/C by first calculating the term AB. The product AB is then set on the switches SD as the factor D and is finally divided by C by the method previously described.

The invention has been described as applied to a manually operable machine for the sake of clarity but it will be appreciated that it is not restricted to such machines as its basic principles are also applicable to machines controlled by perforated cards.

In the apparatus described above each result digit is obtained first in the decadal notation and then in the hendecadal notation. The result digit could be obtained in both notations simultaneously by duplicating all the circuits, one group of circuits being arranged for the decadal notation alone and the other for the hendecadal notation alone. This would allow of the simultaneous closure of two circuits to give the result digit in both notations, in which case the use of notation-changing commutators would be avoided and the speed of working could be doubled.

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Fig. 1.

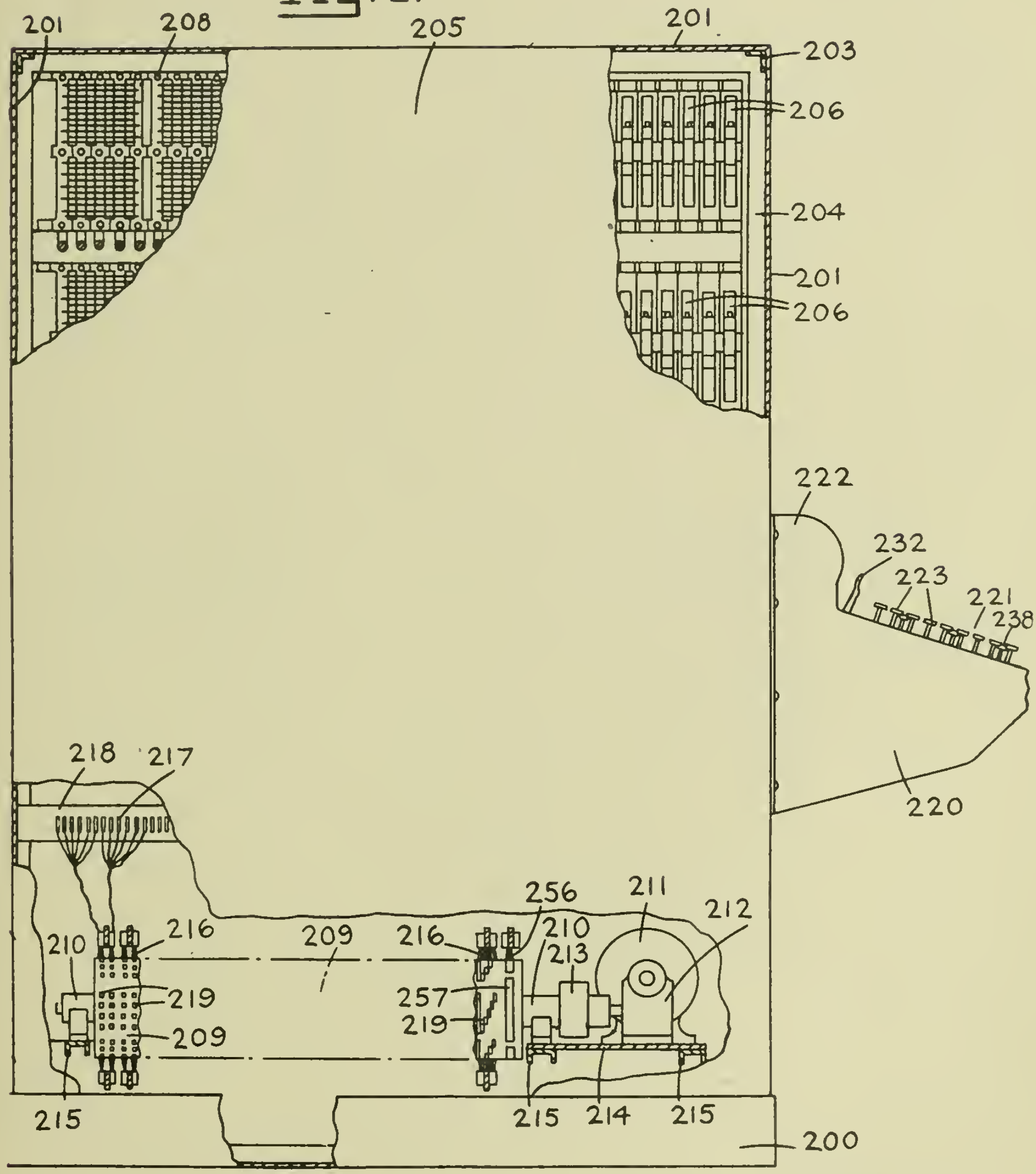

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Fig.2.

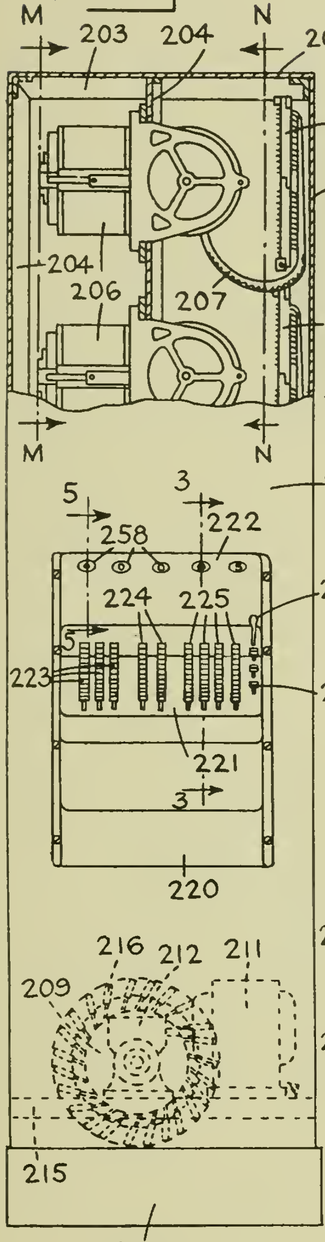

Fig.2A.

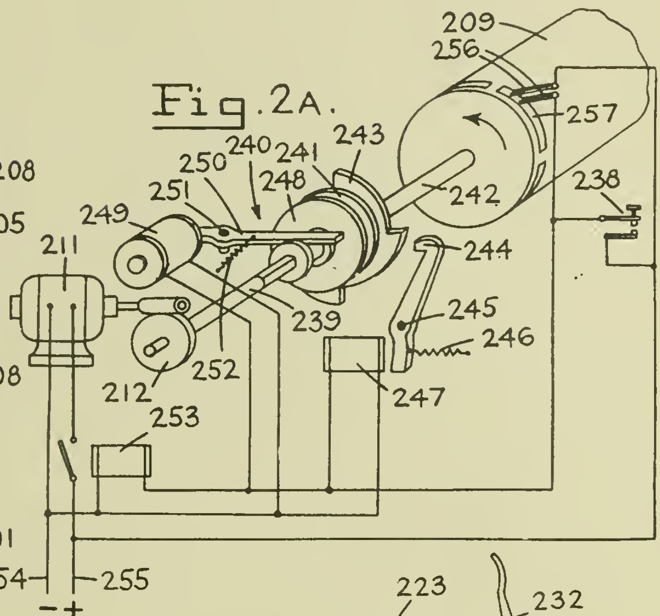

Fig.4.

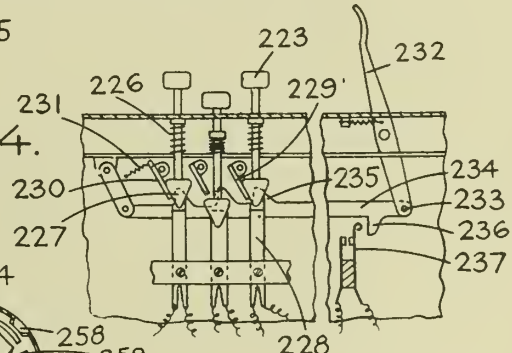

Fig.3.

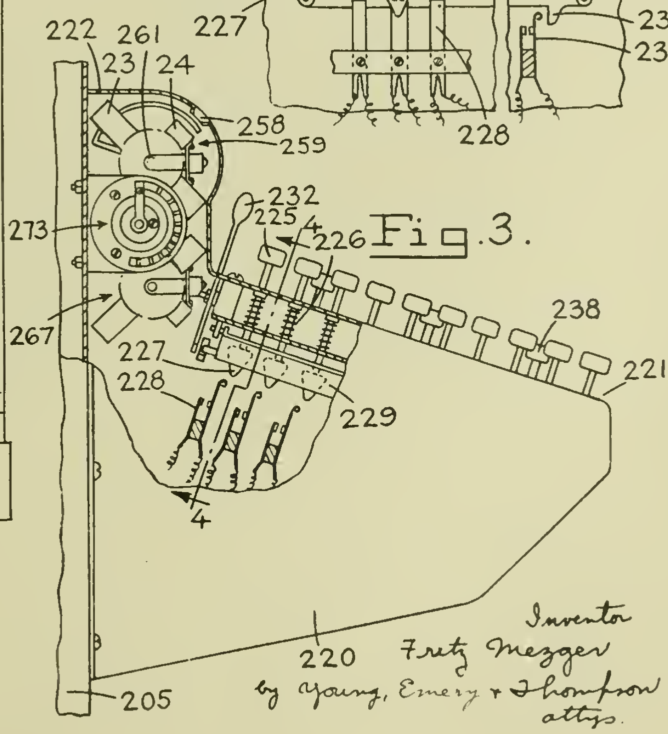

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Fig. 5.

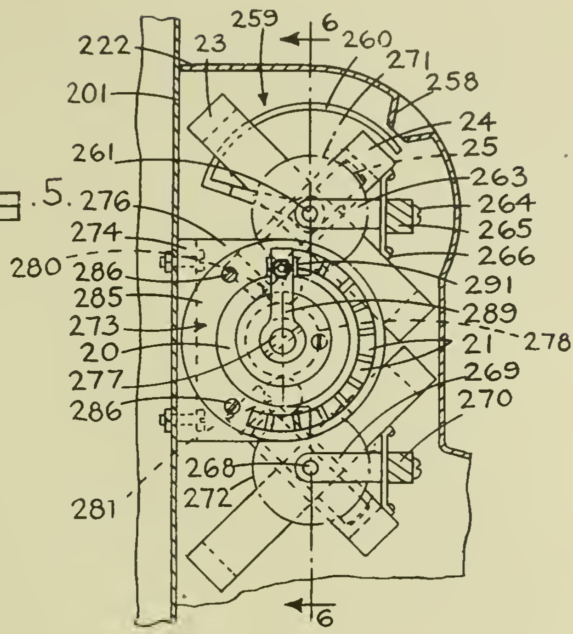

Fig. 6.

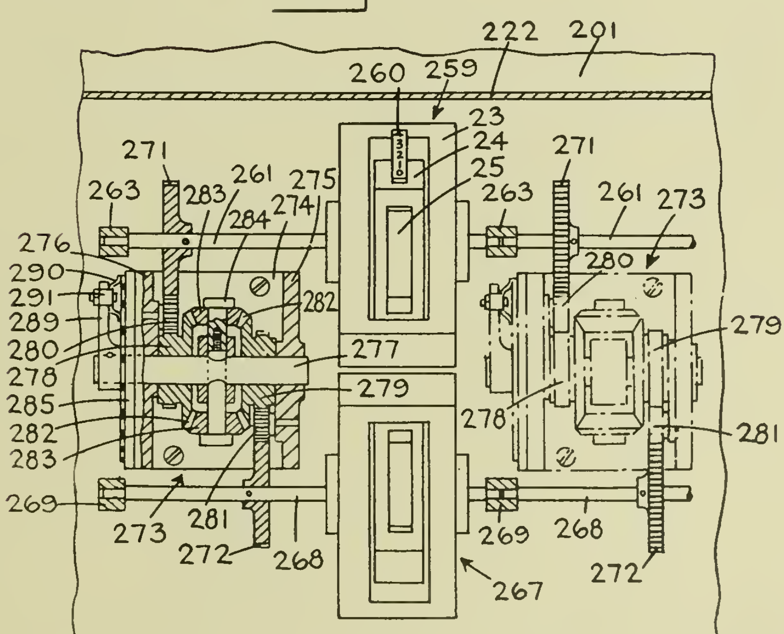

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Fig. 7.

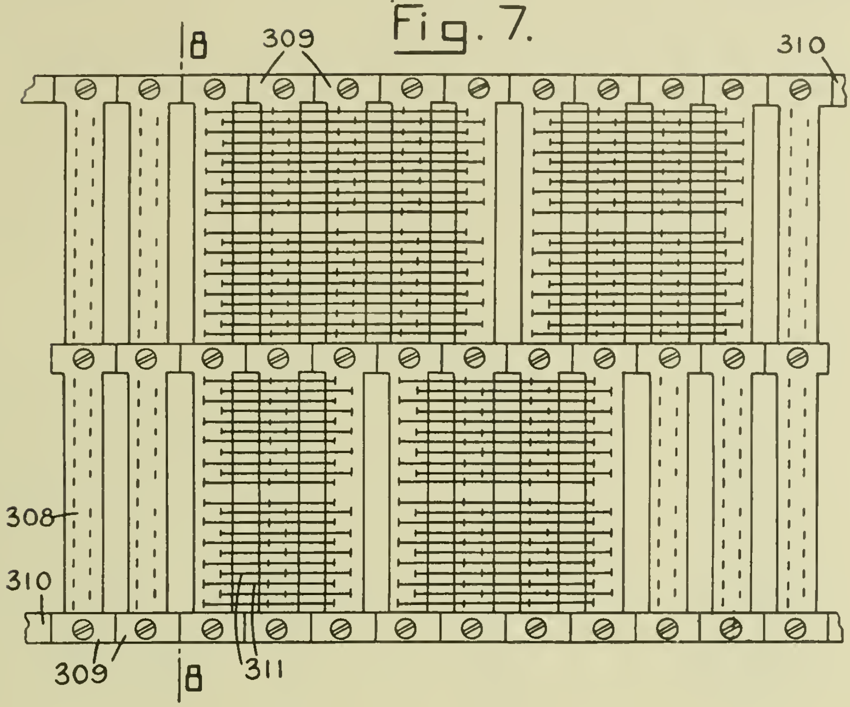

Fig. 8.

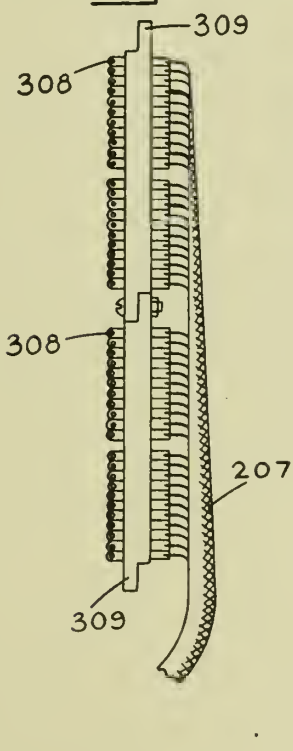

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Fig. 9.

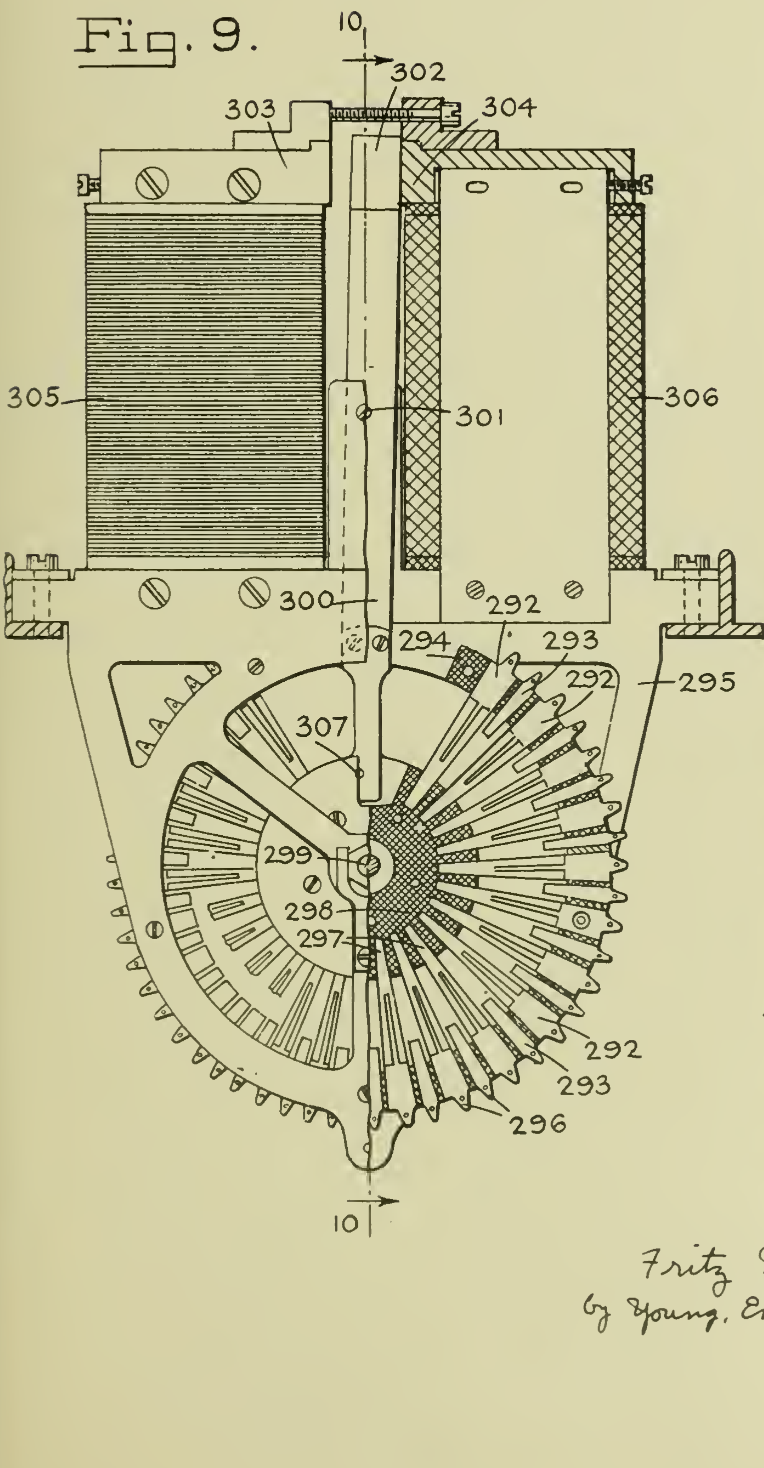

Fig. 10.

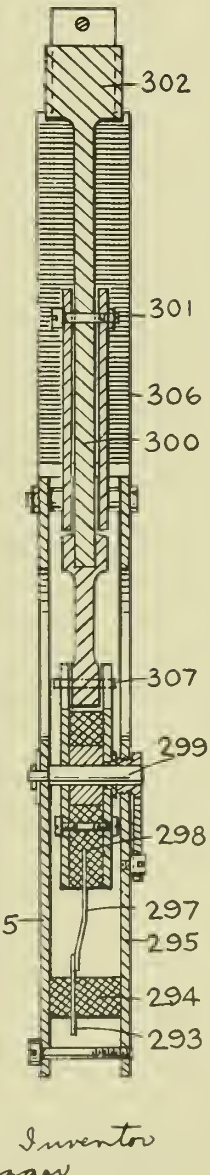

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Fig. 11A.

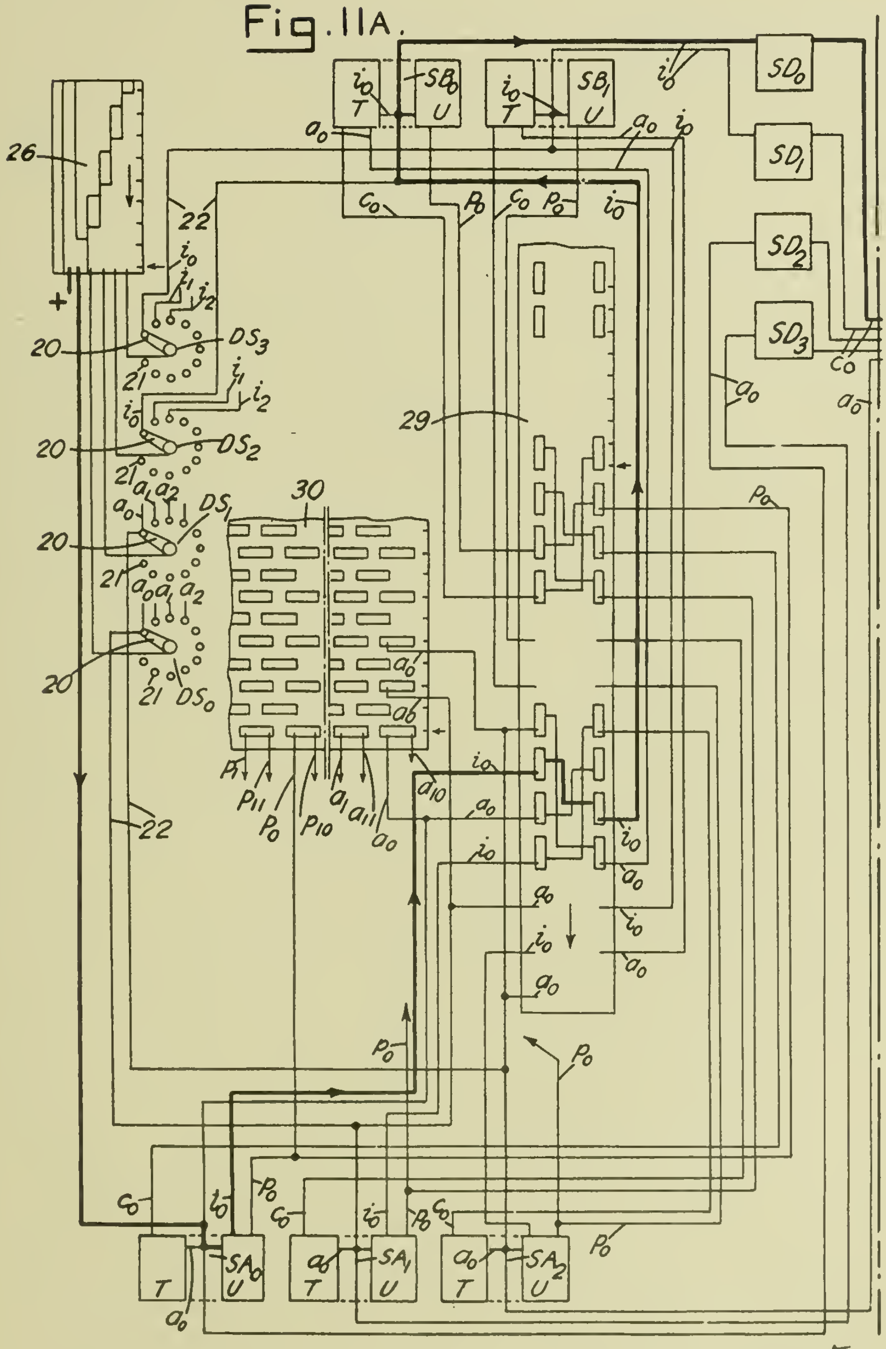

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Fig. 11B.

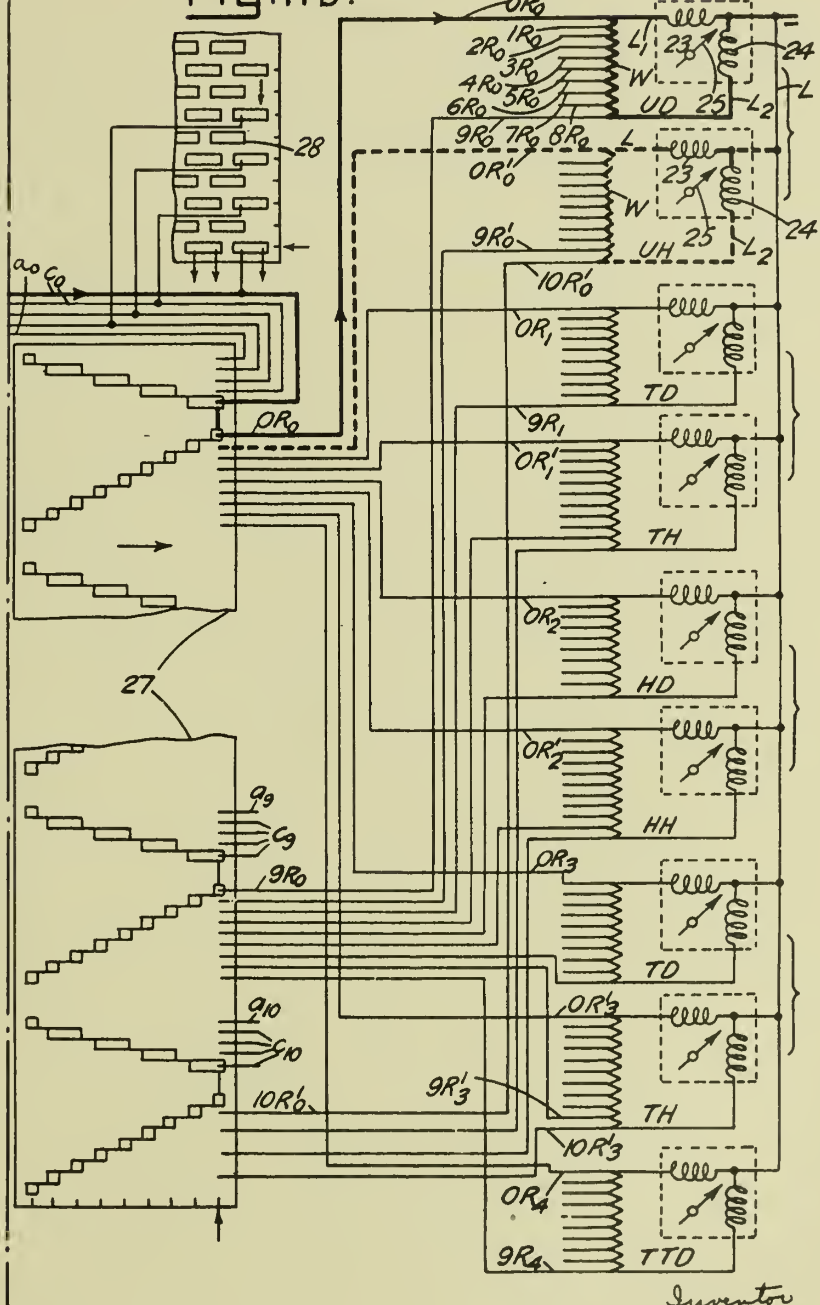

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Fig. 12A.

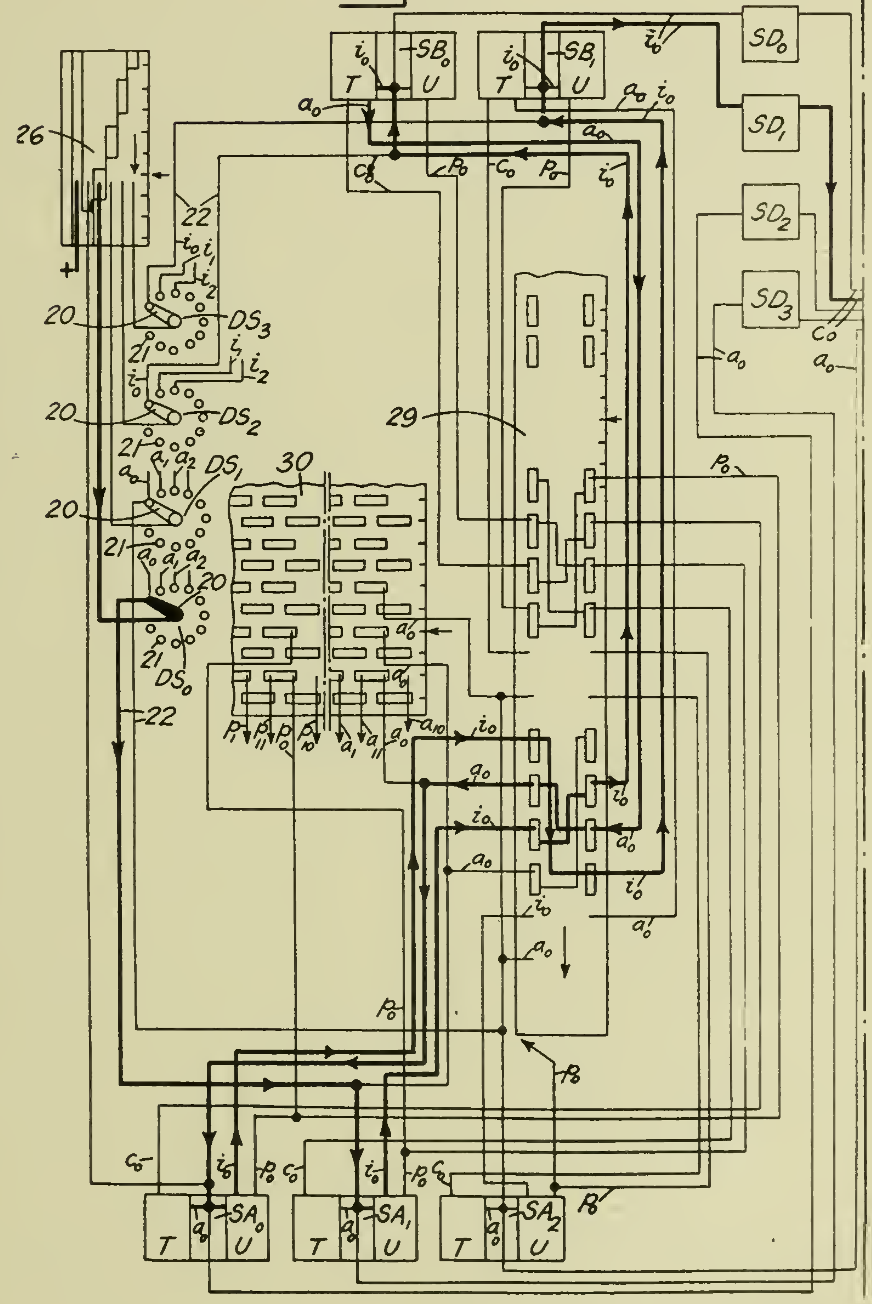

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Fig. 12B.

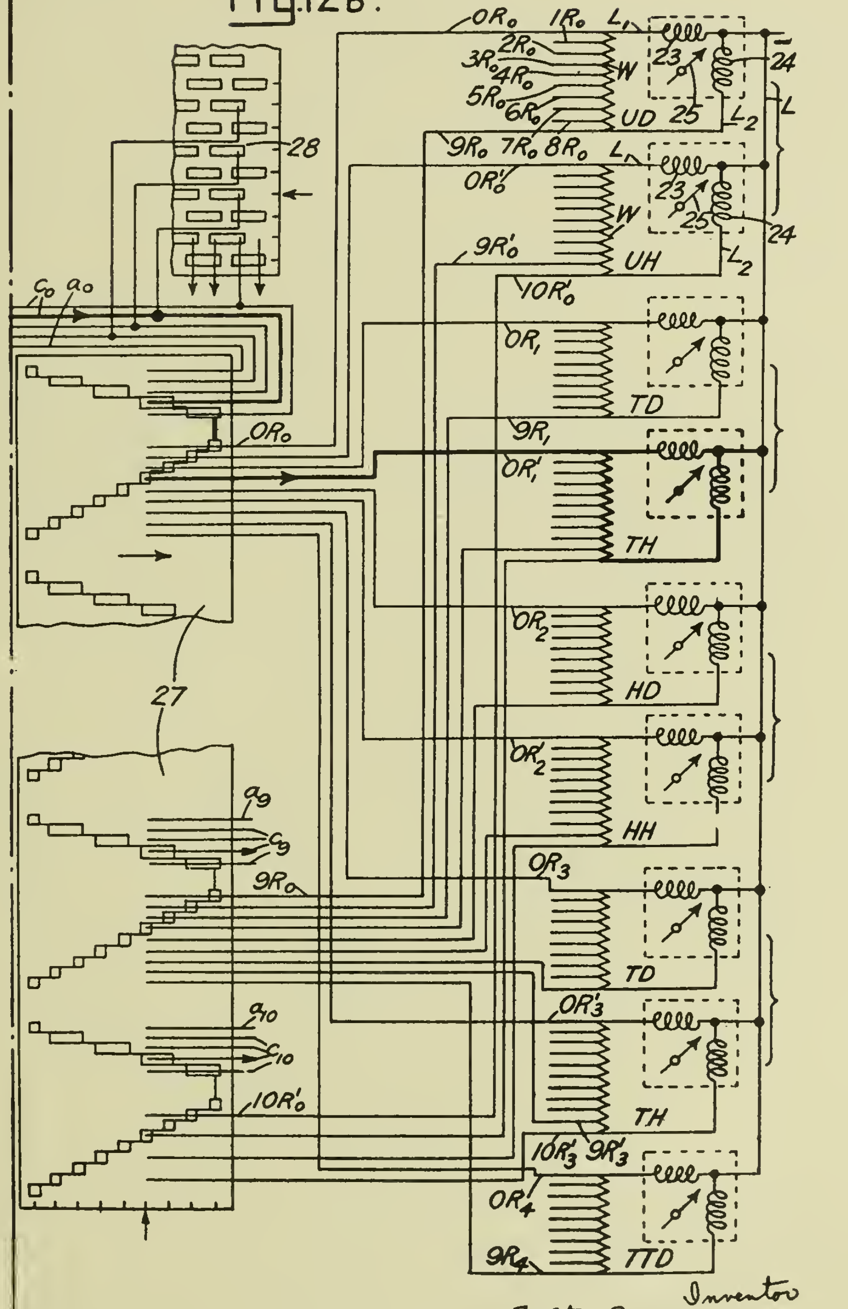

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Fig. 13.

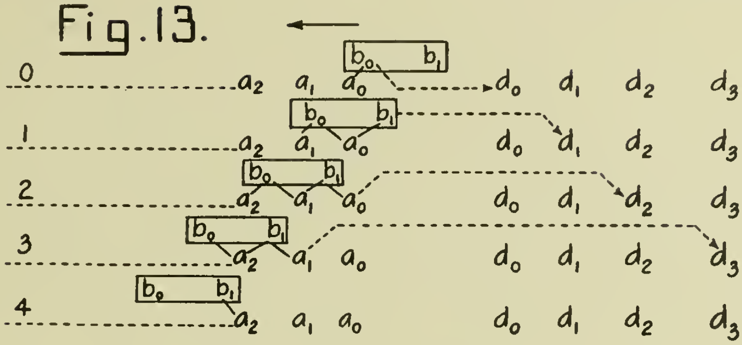

Fig. 14.

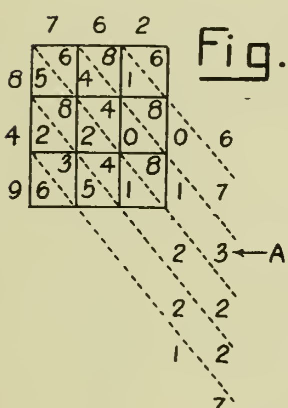

Fig. 15.

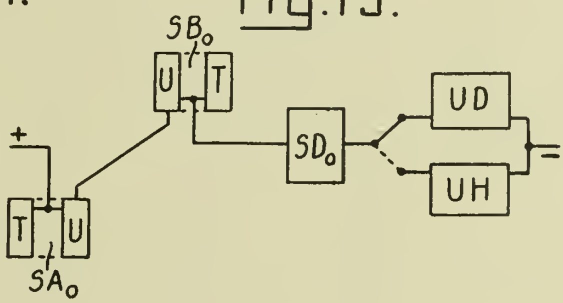

Fig. 16.

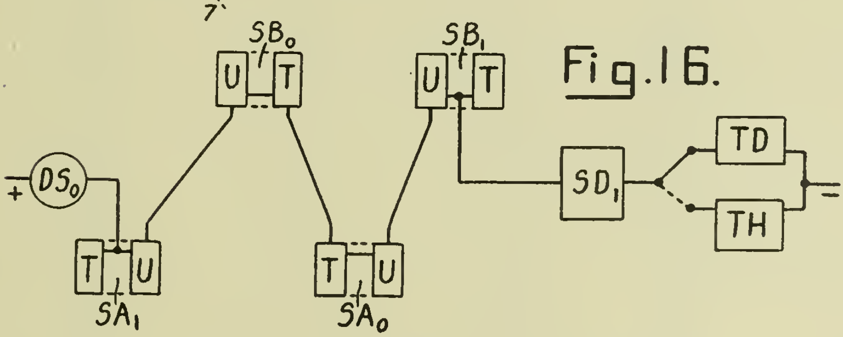

Fig. 17.

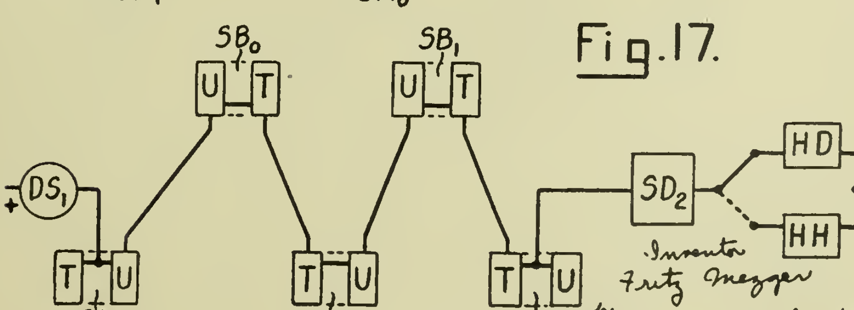

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Fig. 18 A.

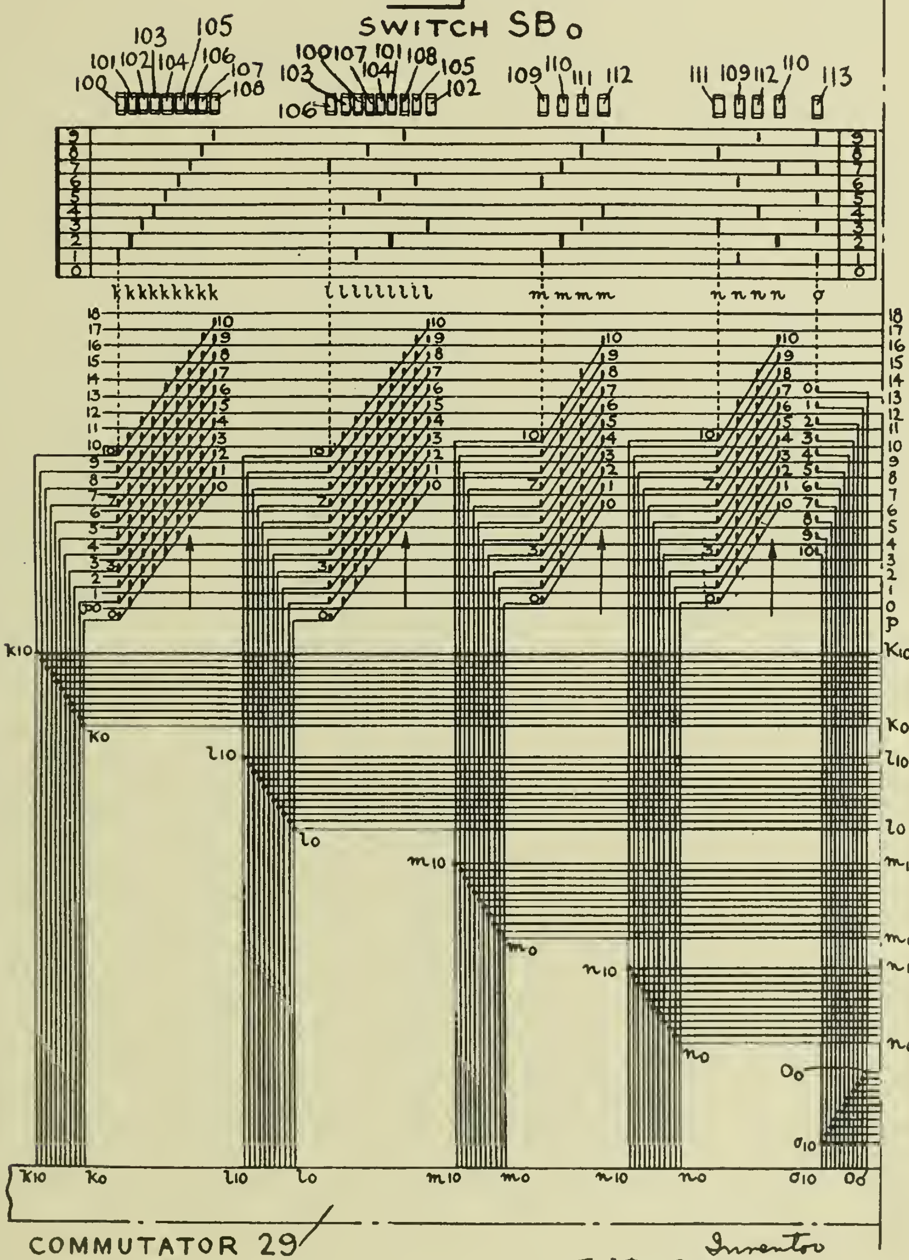

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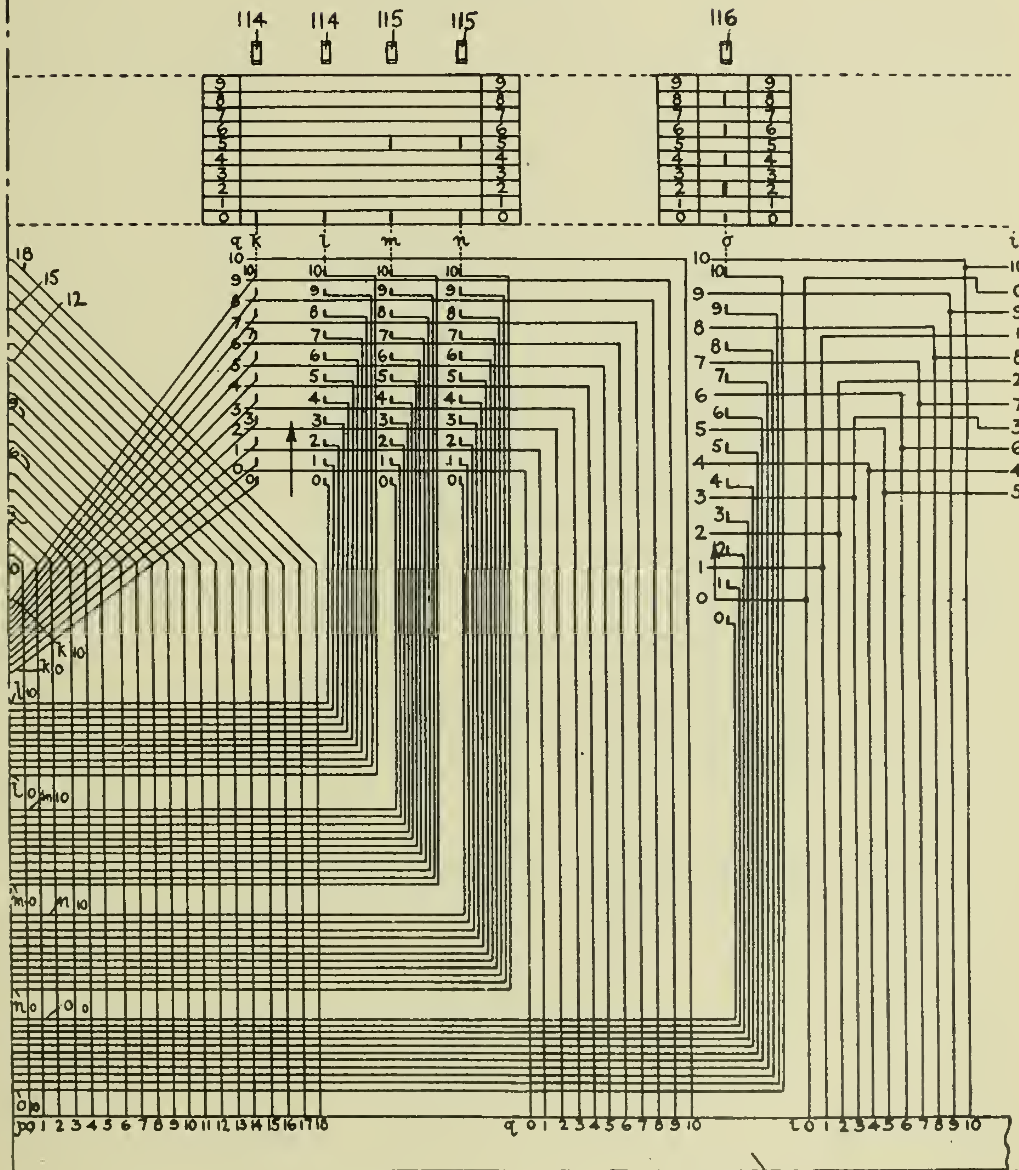
Fig. 18 B.

SWITCH SBo



COMMUTATOR 29

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Fig. 18 C.

SWITCH SBo

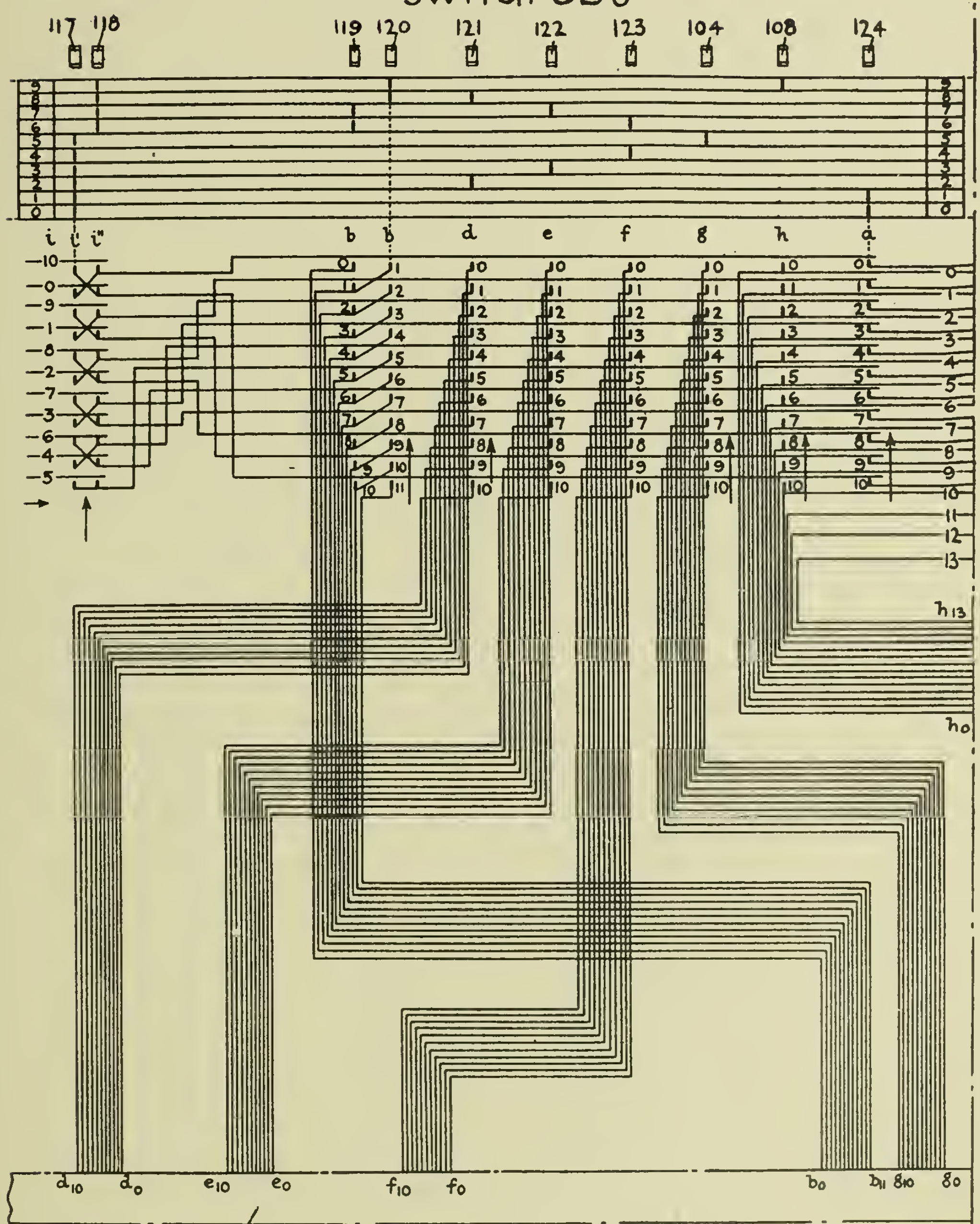

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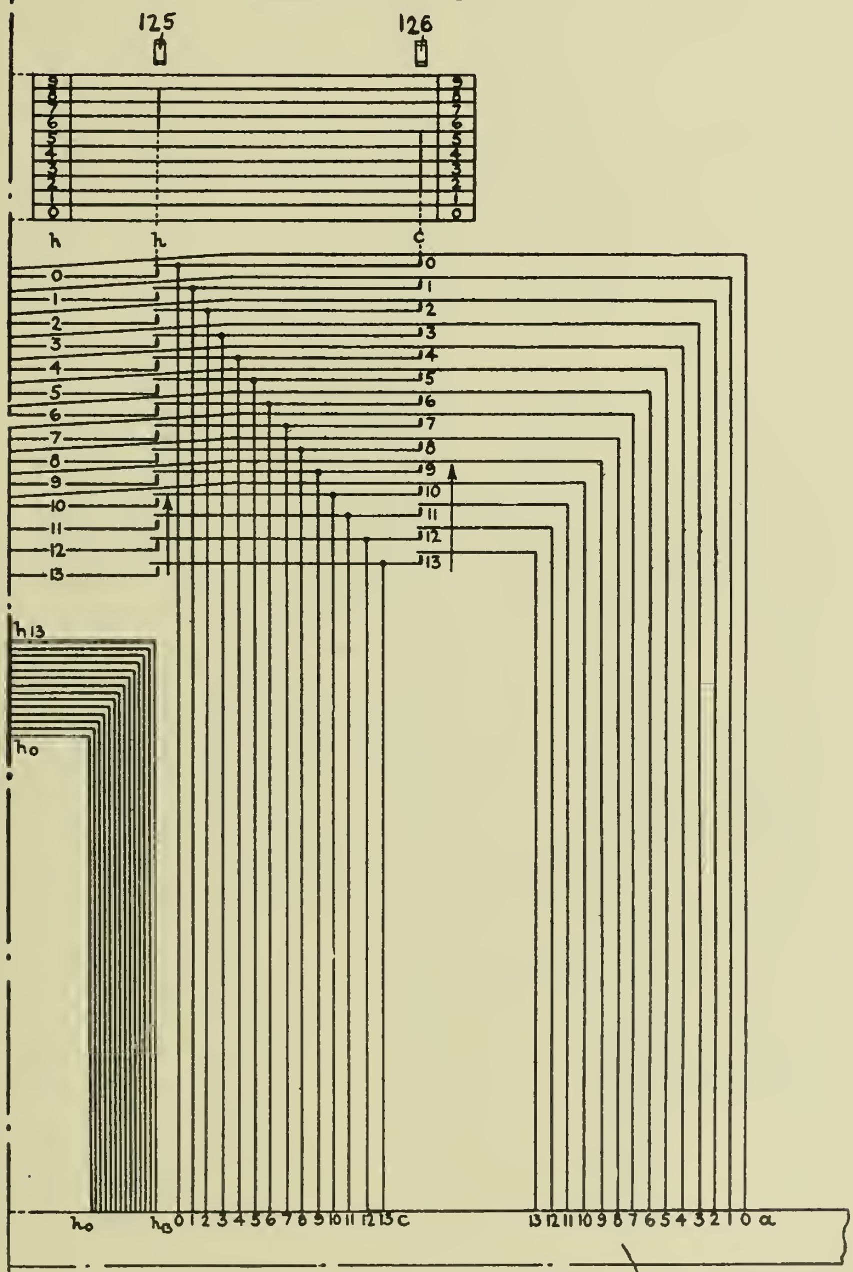
Fig. 18 D.
SWITCH SBo



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Filed May 24, 1938

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209,832

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Fig. 19A.

SWITCH SB1

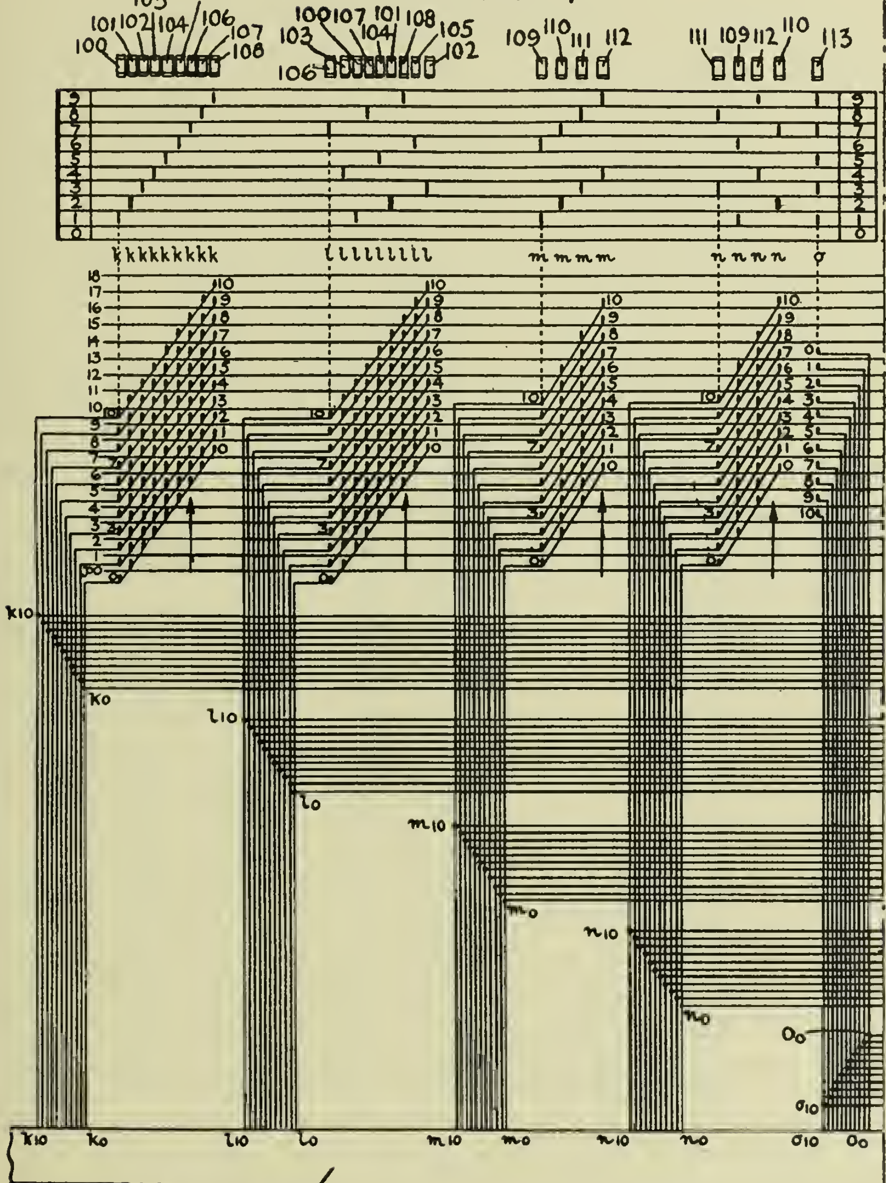

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Fig. 19 B.

SWITCH SB_1

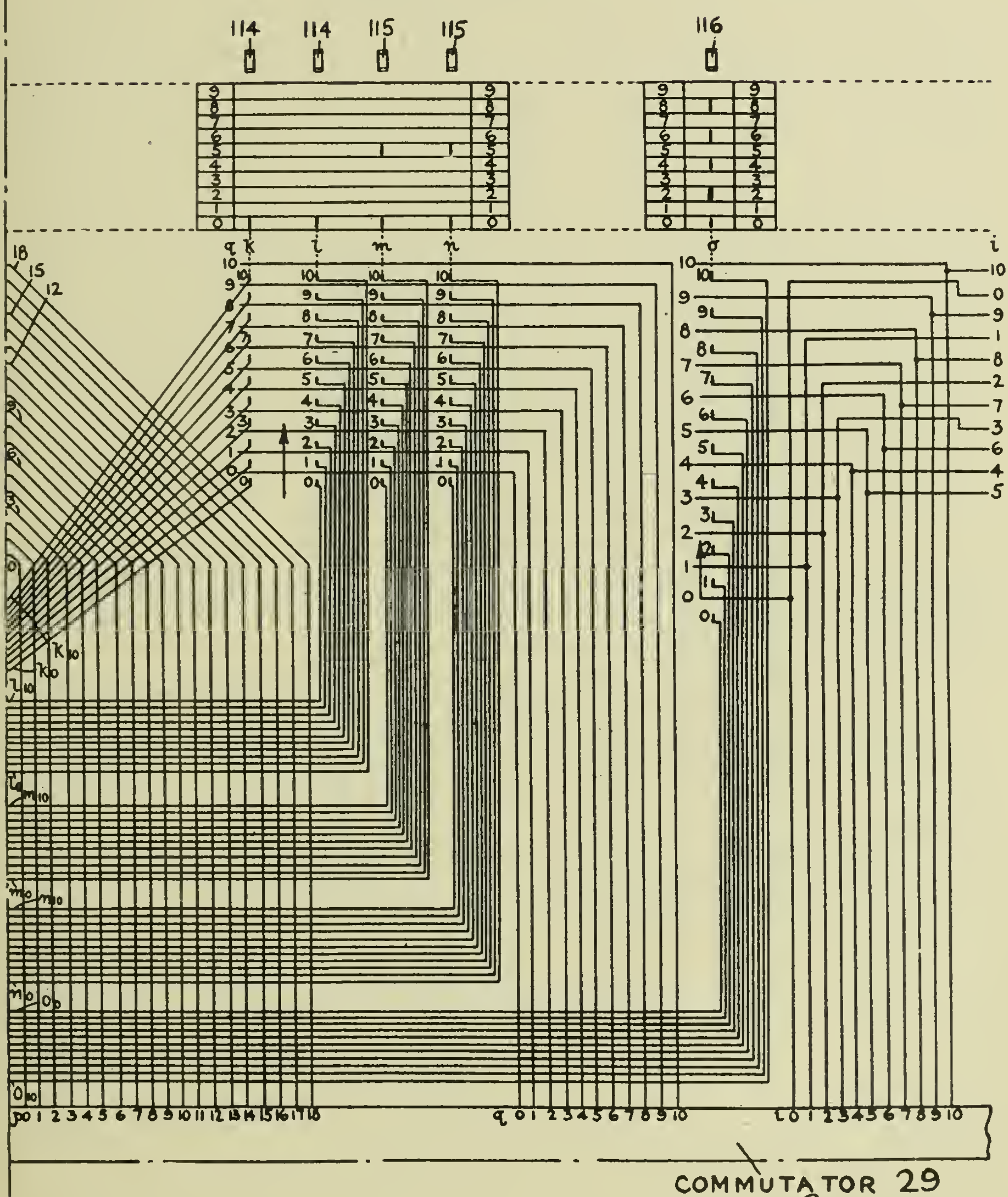

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Fig. 19 C.

SWITCH SB_1

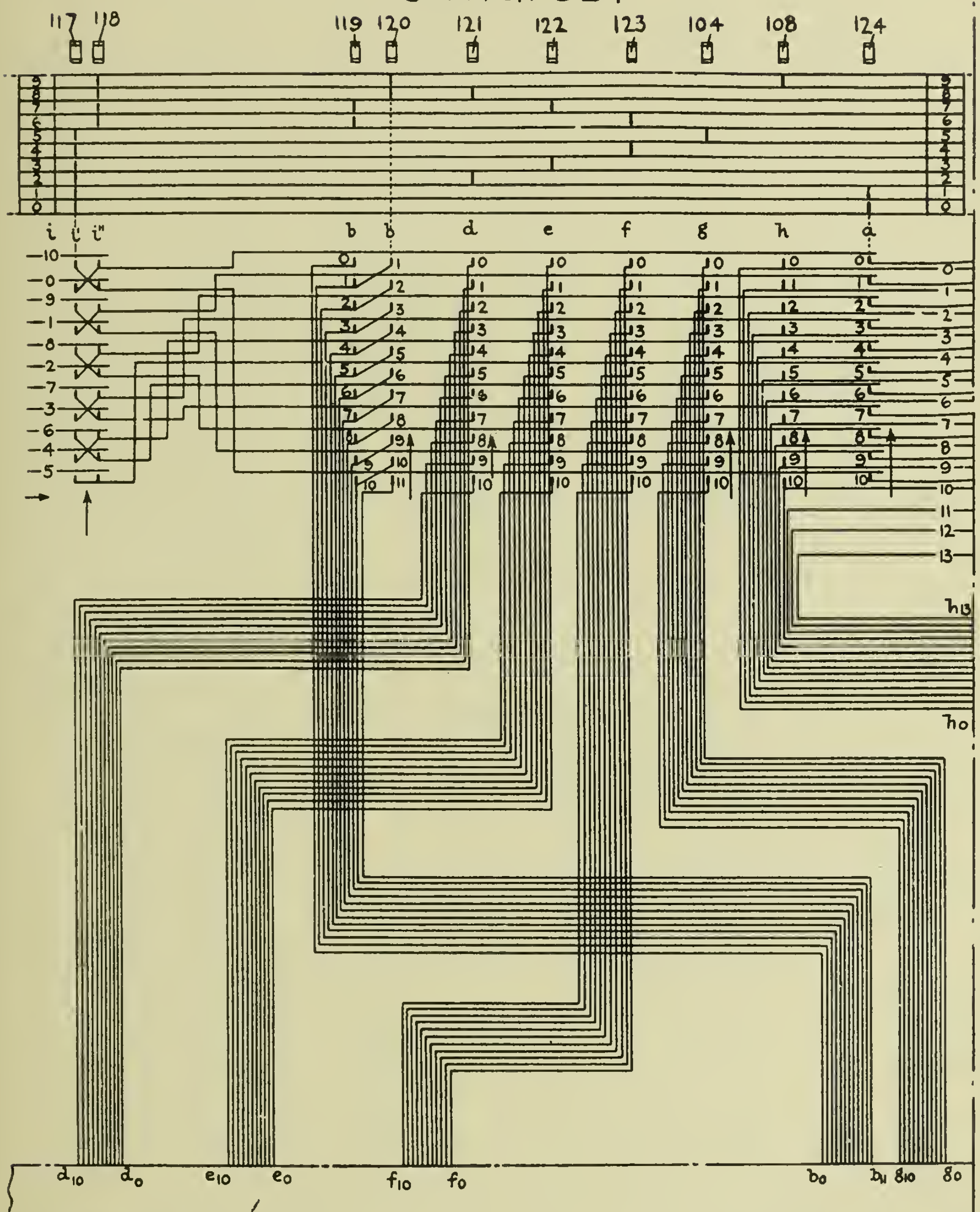

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Fig. 19 D.

SWITCH SB_1

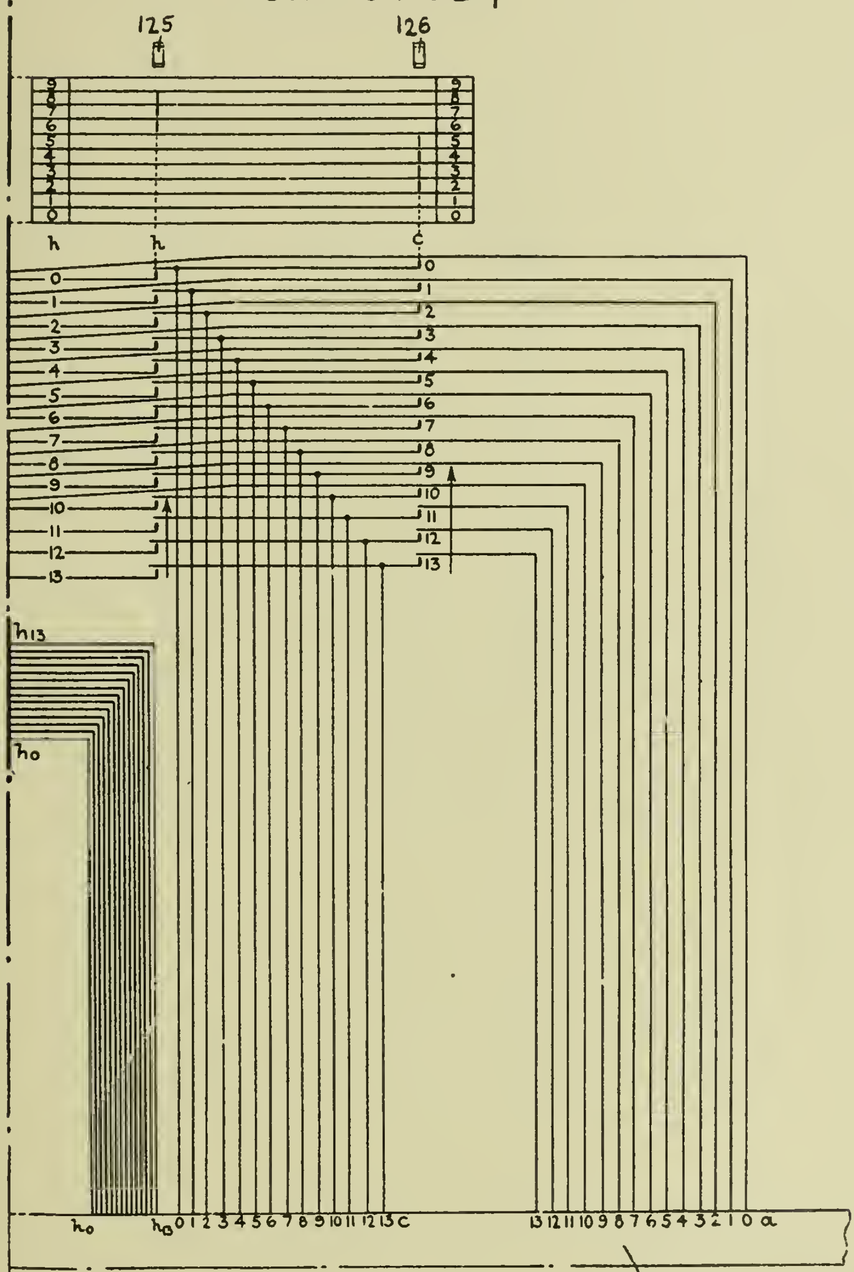

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Fig. 20A.

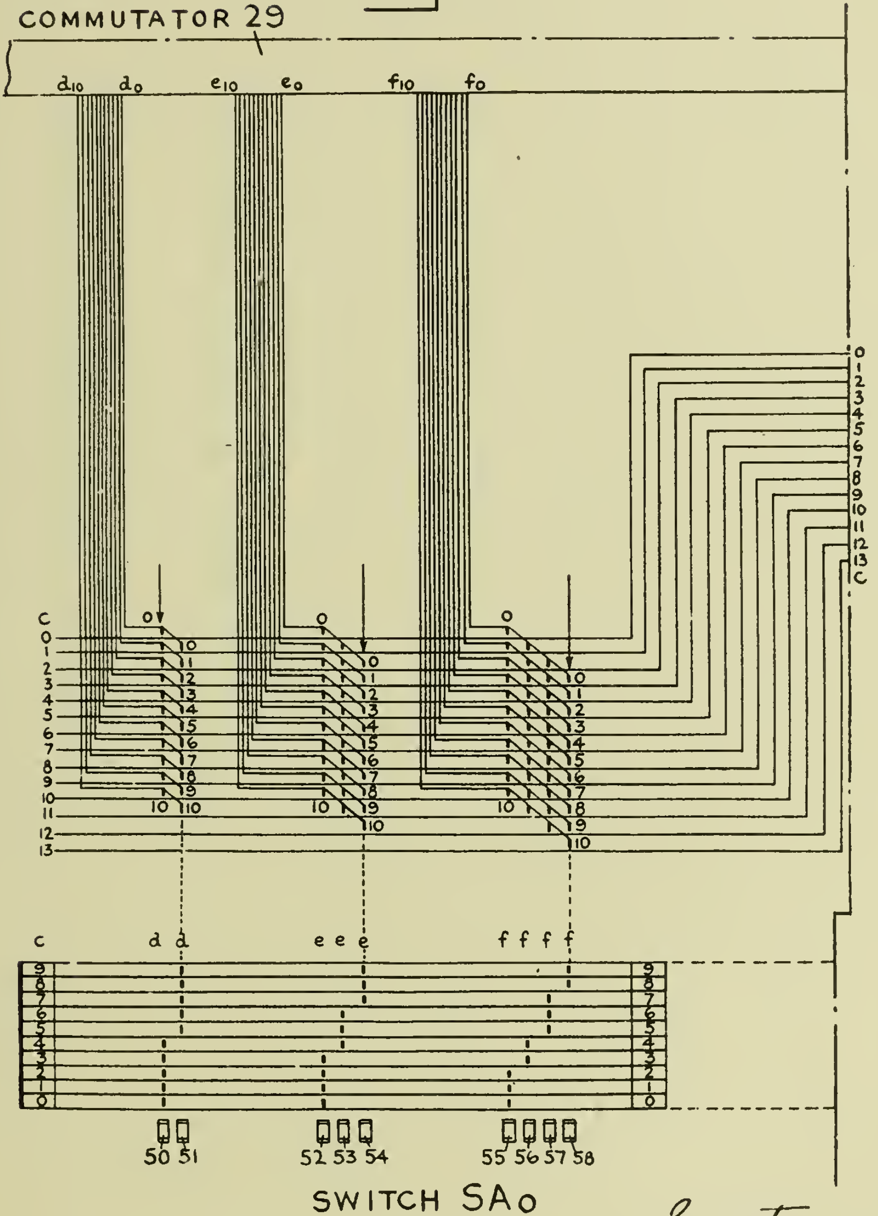

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Fig. 20 B.

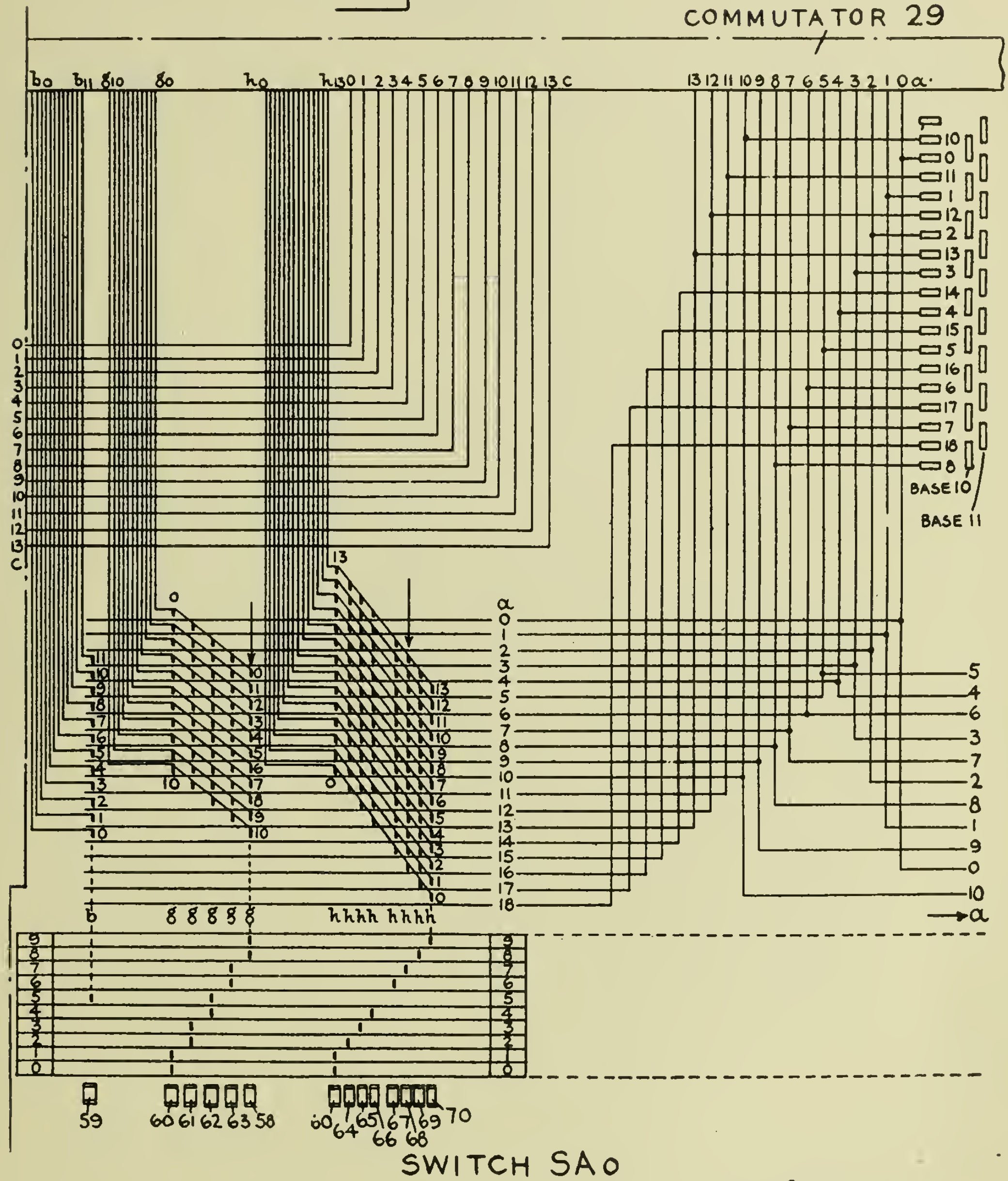

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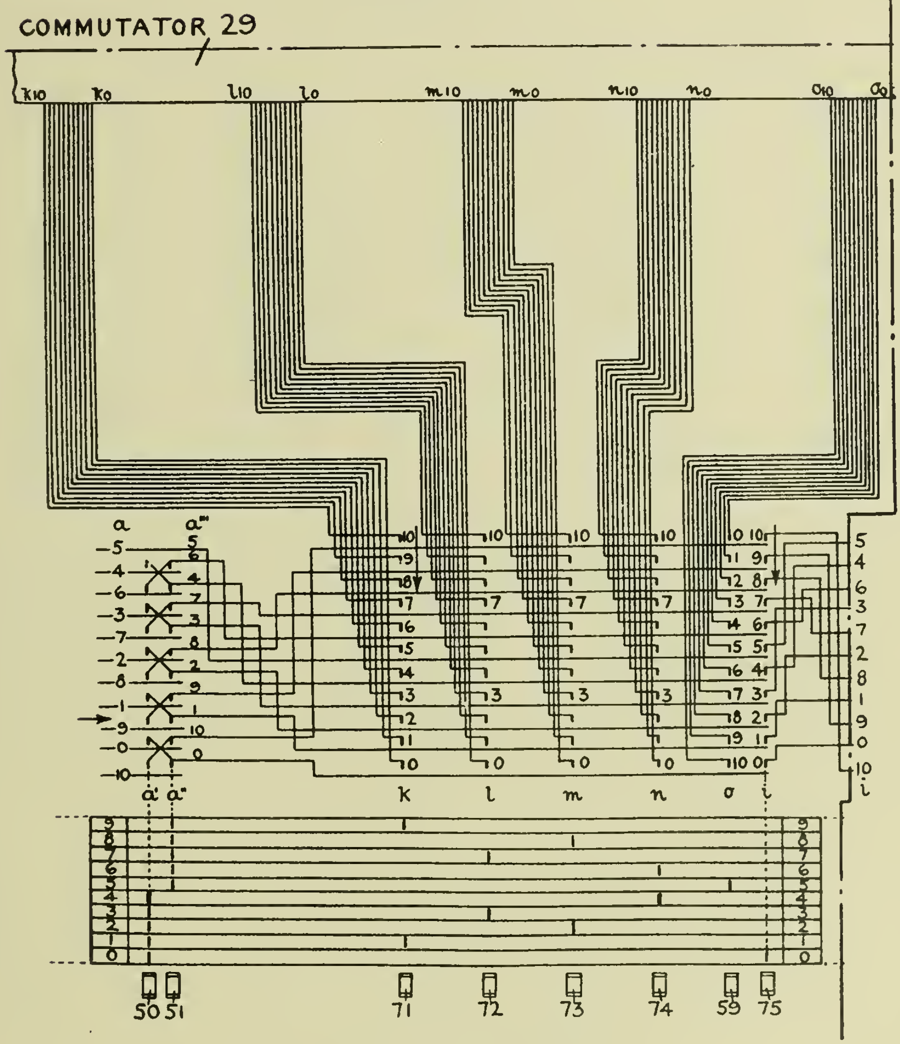
Fig. 20 C.



SWITCH SA0

Inventor:
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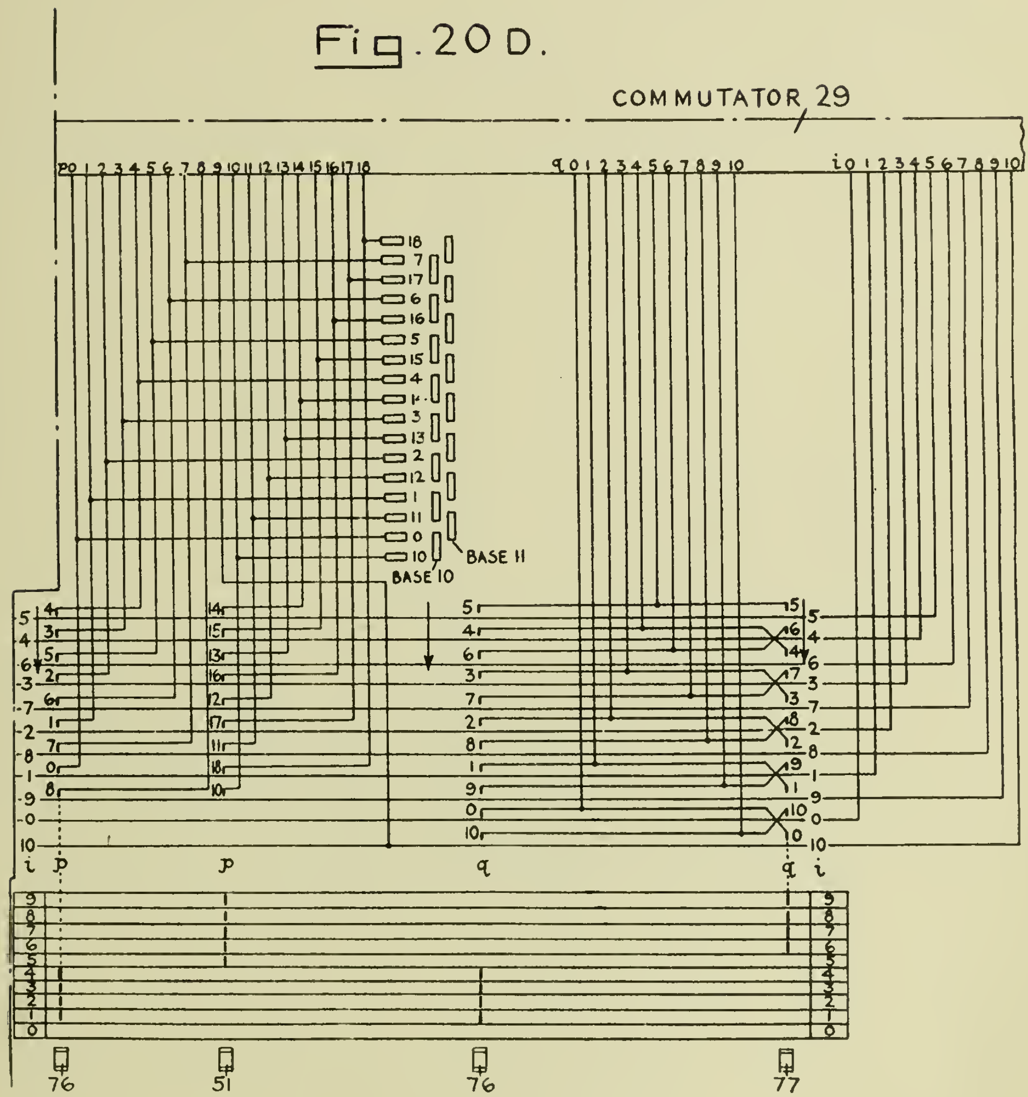
Fig. 20 D.



SWITCH SA_0

Inventor:
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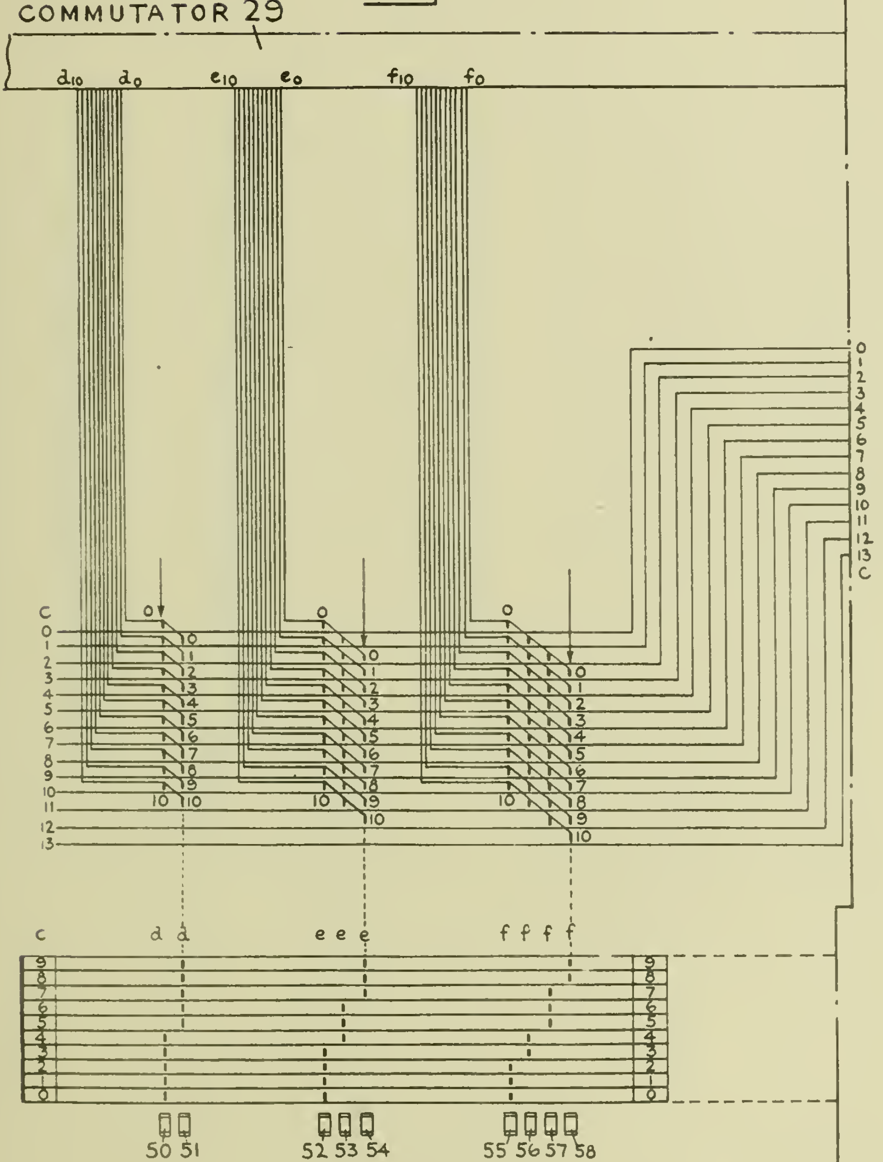
Fig. 21 A.



SWITCH SA1

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Fig. 21 B.

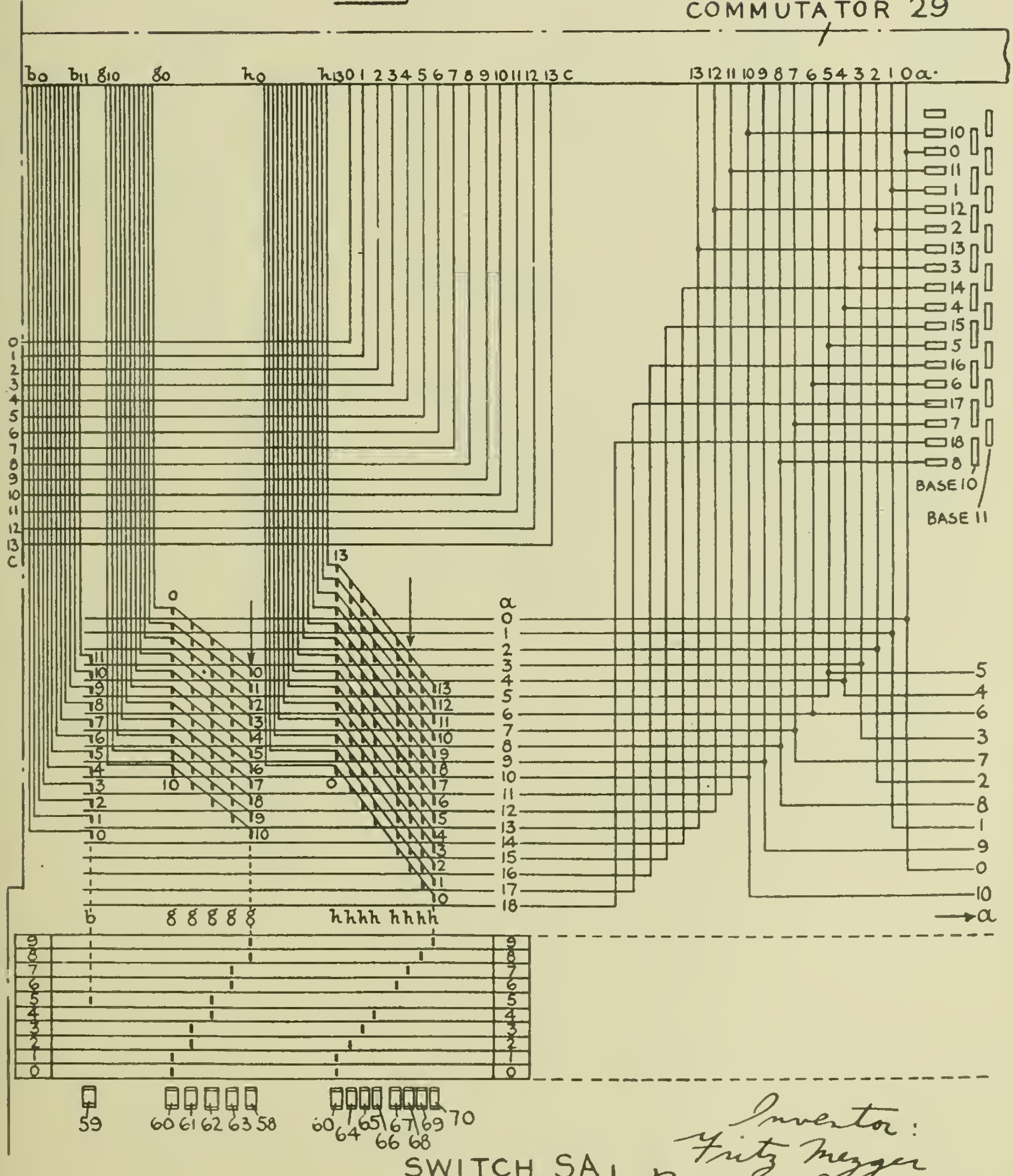

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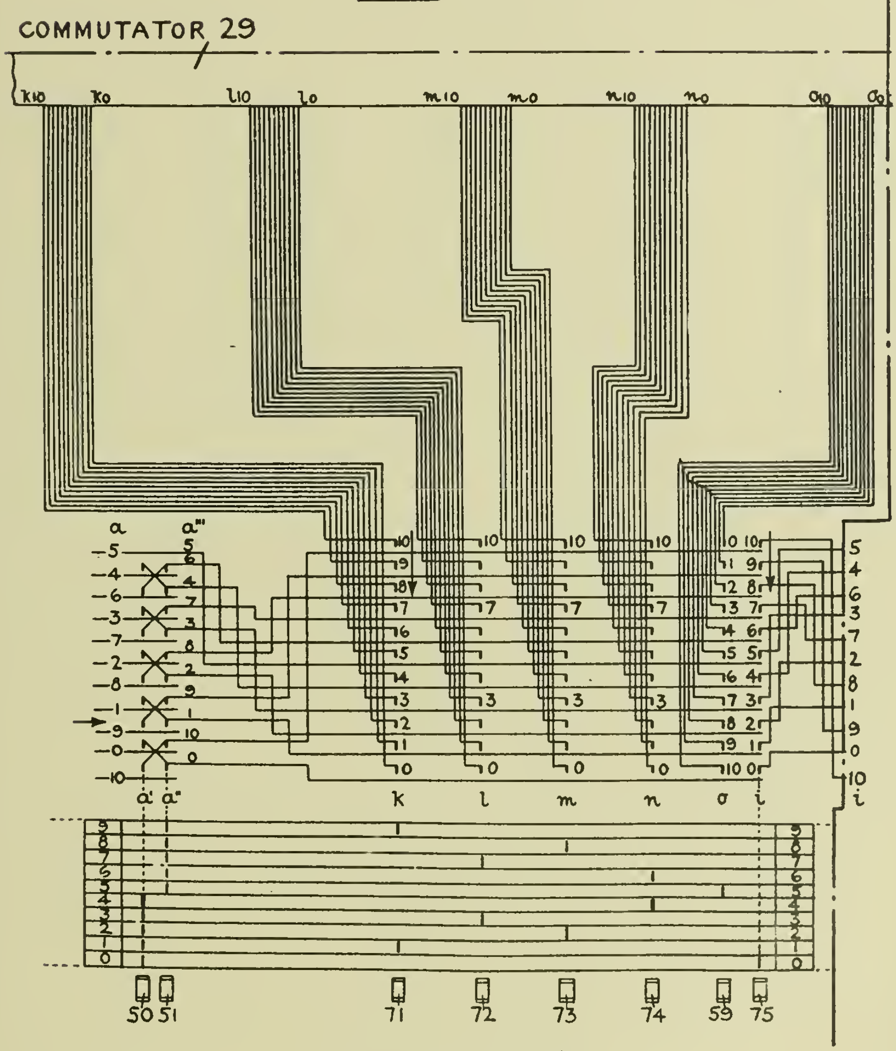
Fig. 21 C.



SWITCH SA$_1$

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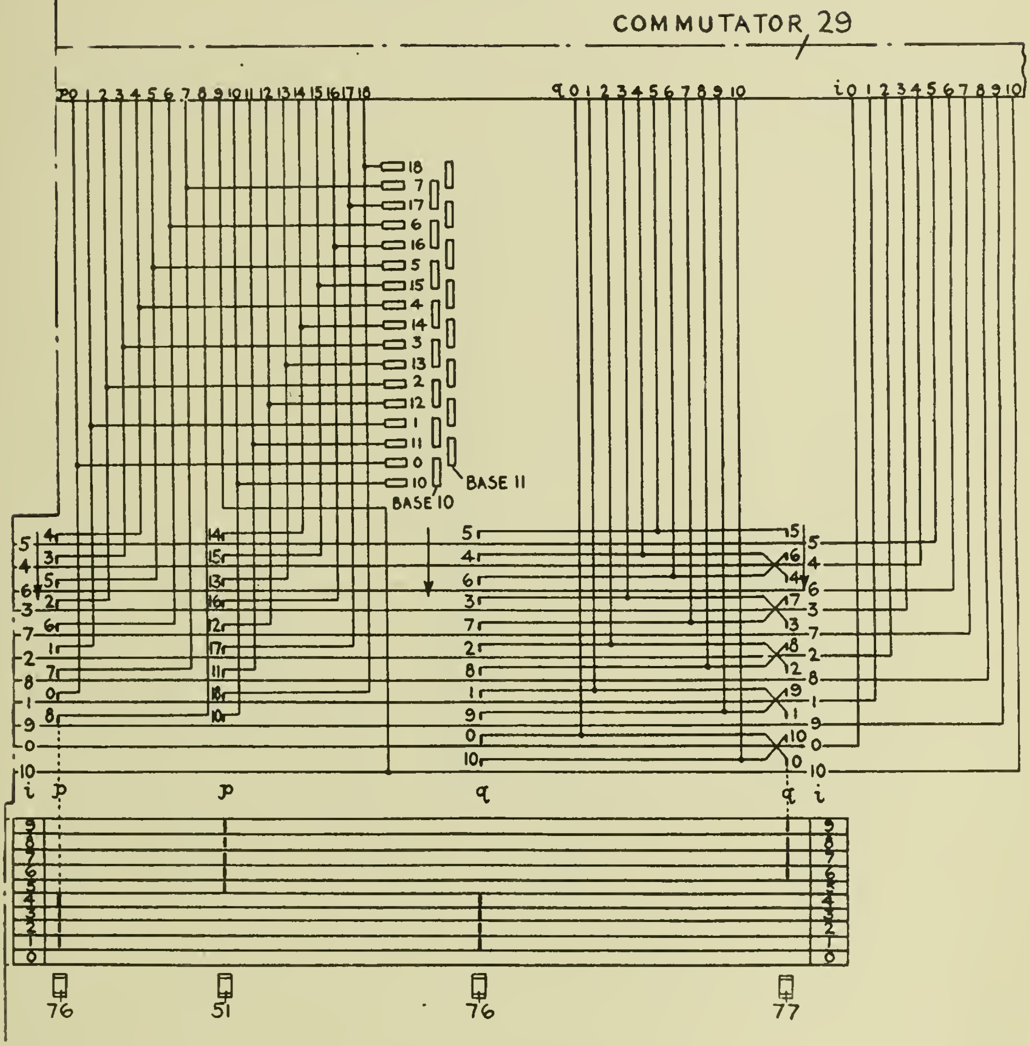
Fig. 21 D.



SWITCH SA1

Inventor
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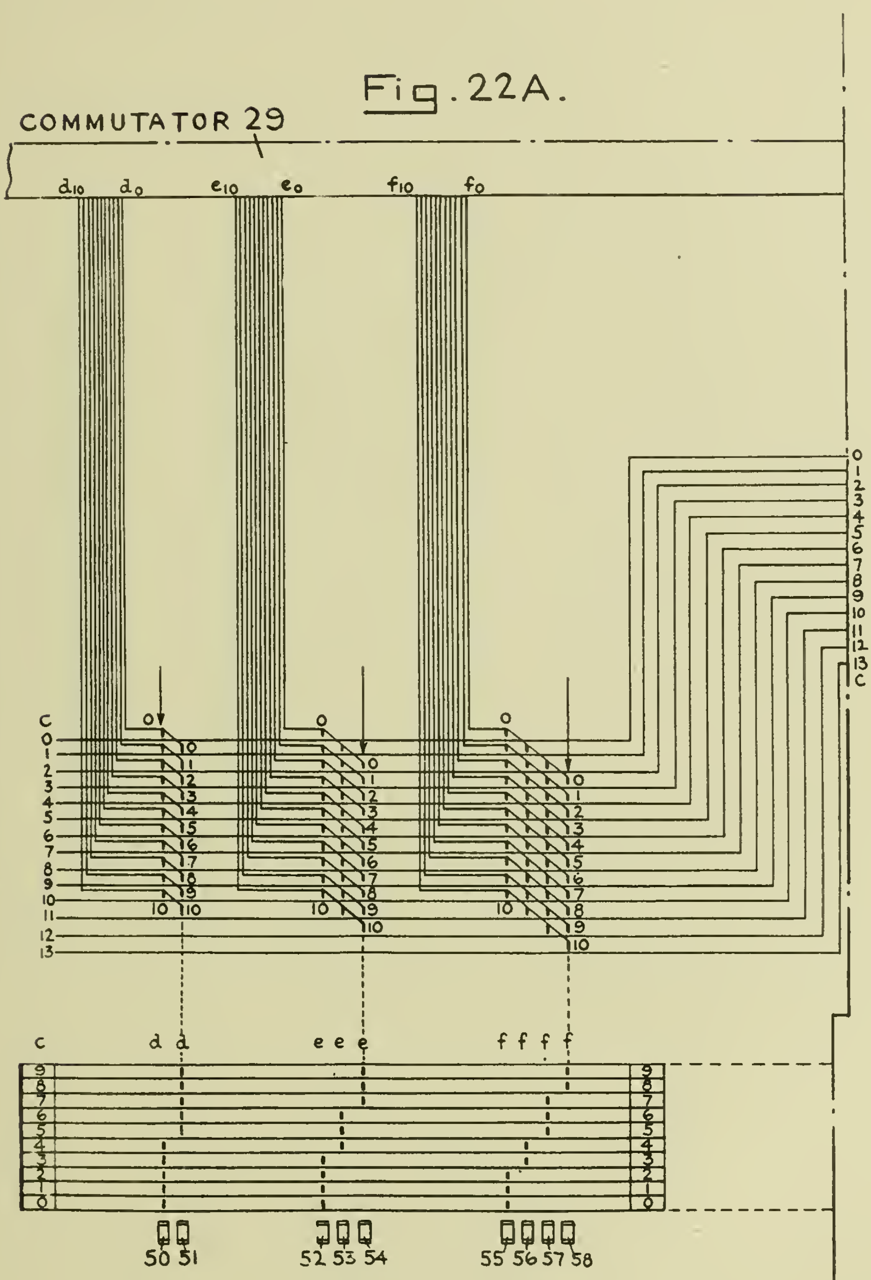
Fig. 22A.



SWITCH SA_2

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Fig. 22 B.

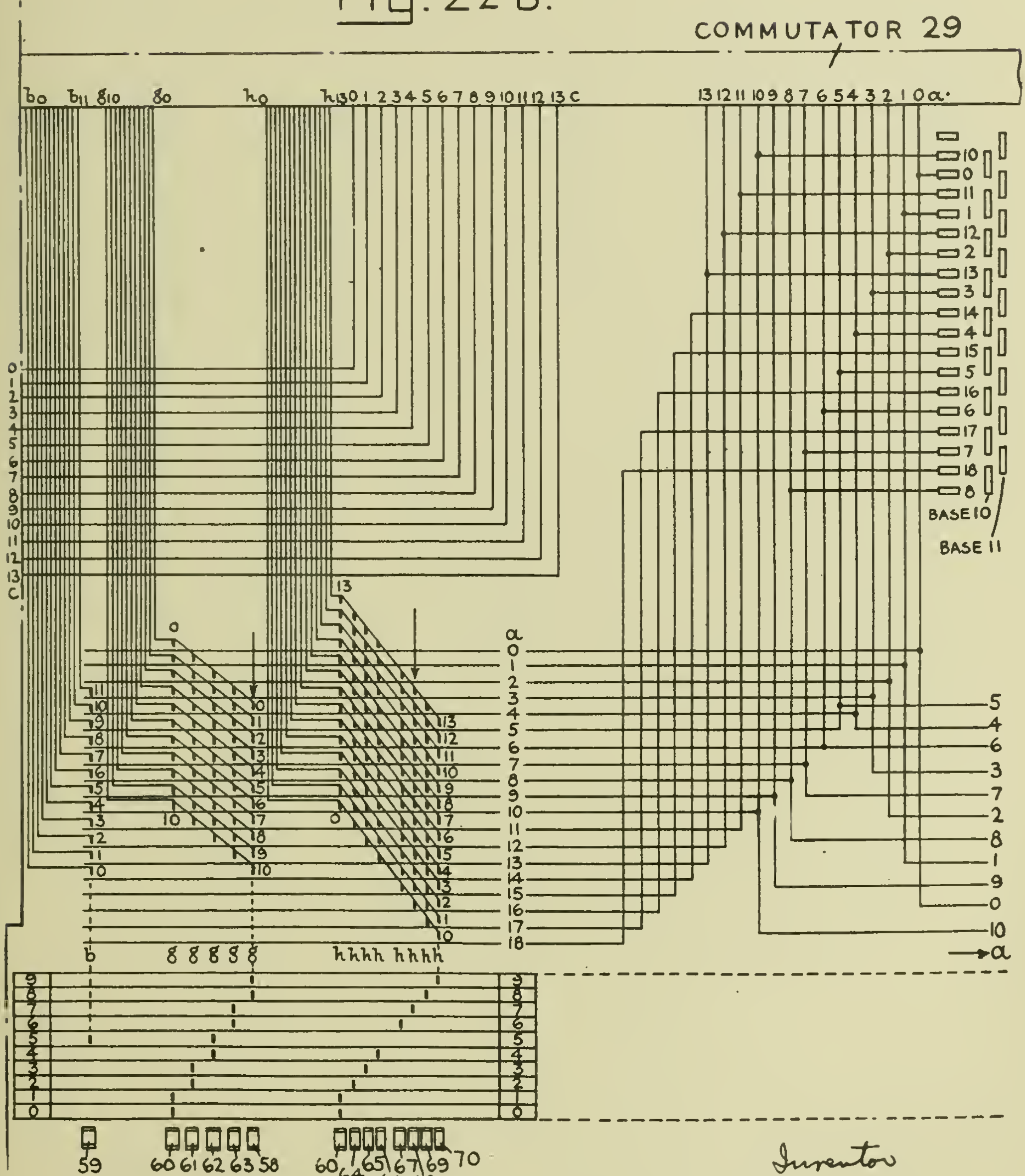

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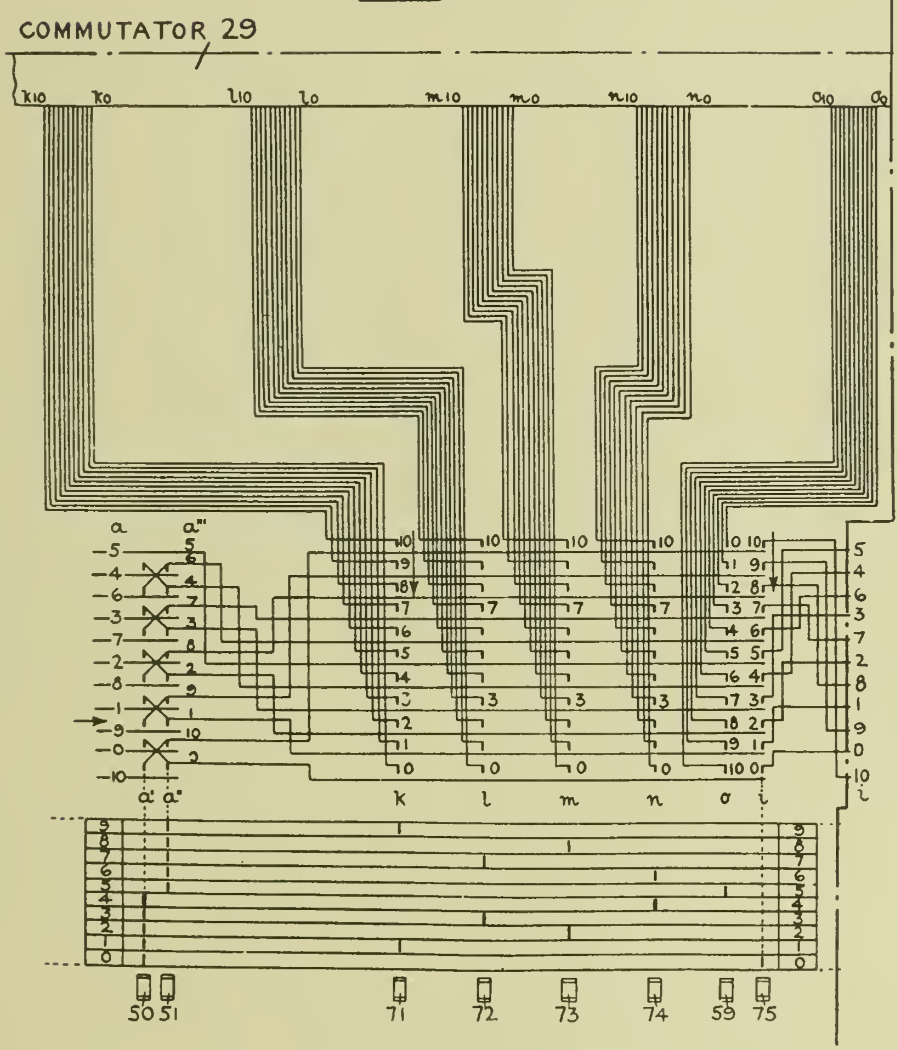
Fig. 22c.



SWITCH SA2

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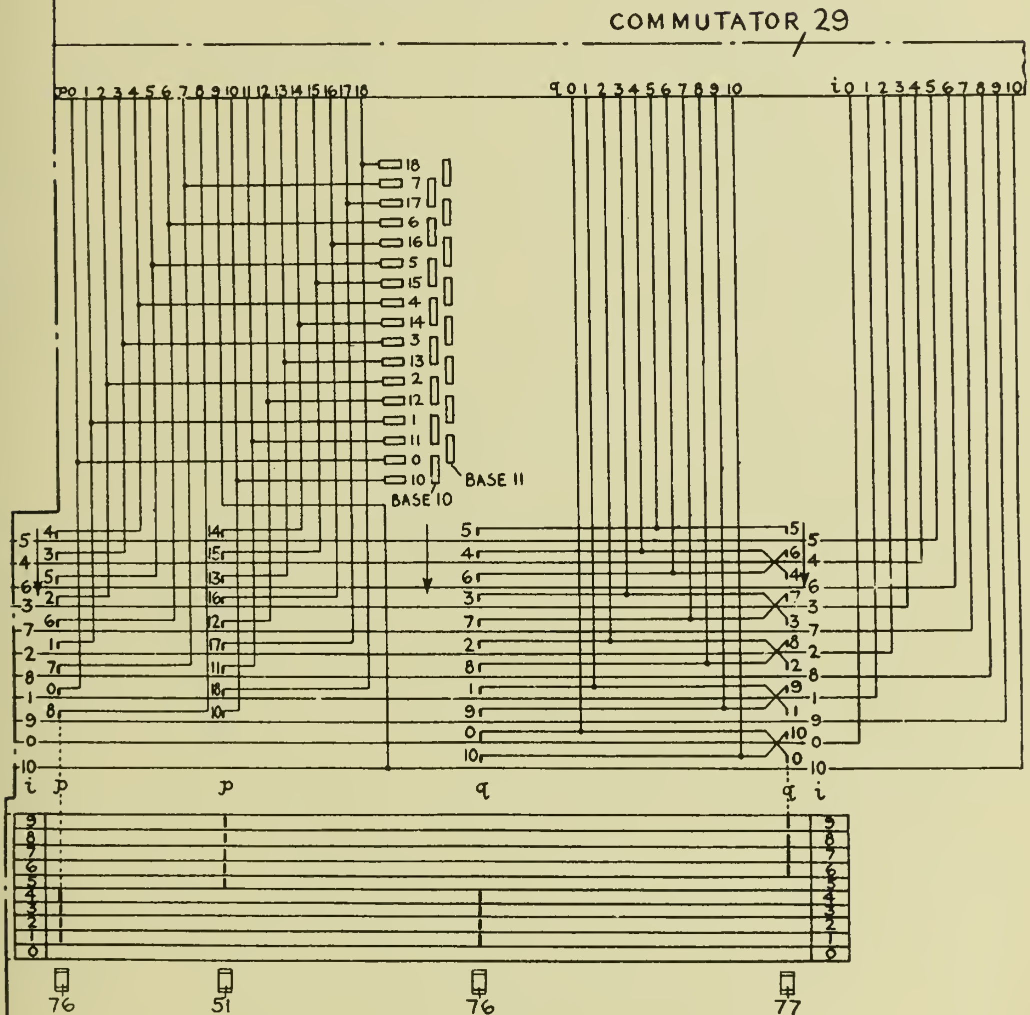
Fig. 22 D.



SWITCH SA2

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Fig. 23.

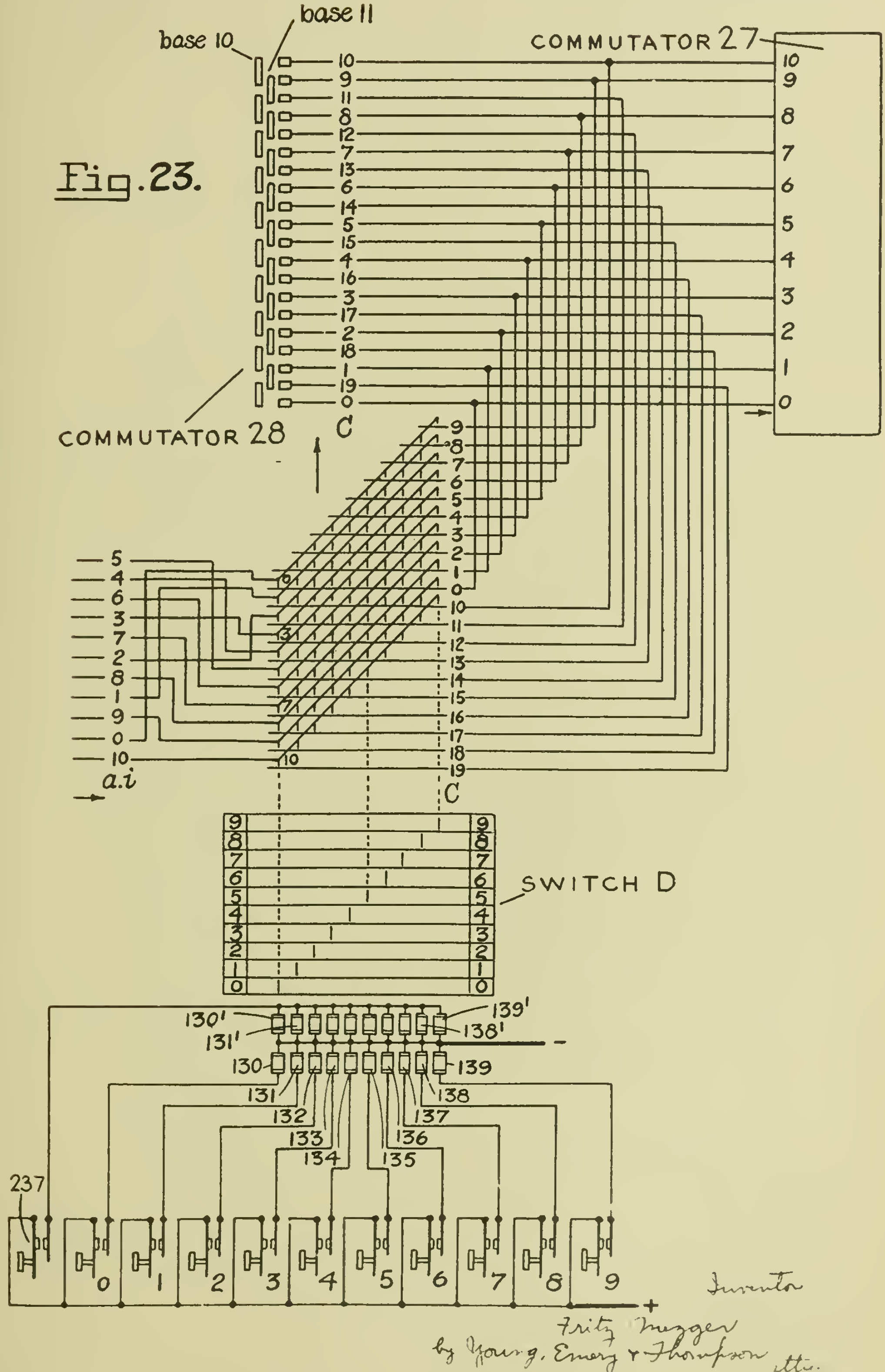

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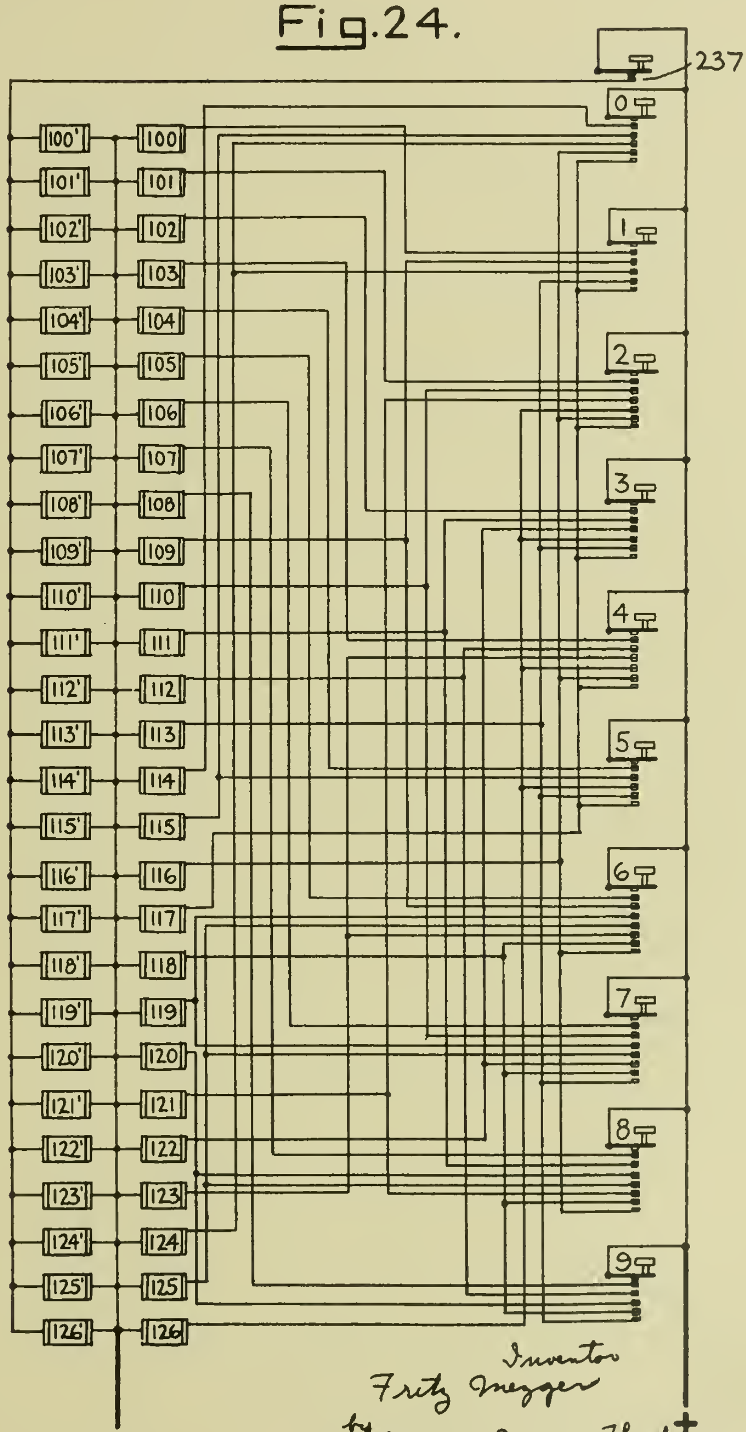
Fig. 24.



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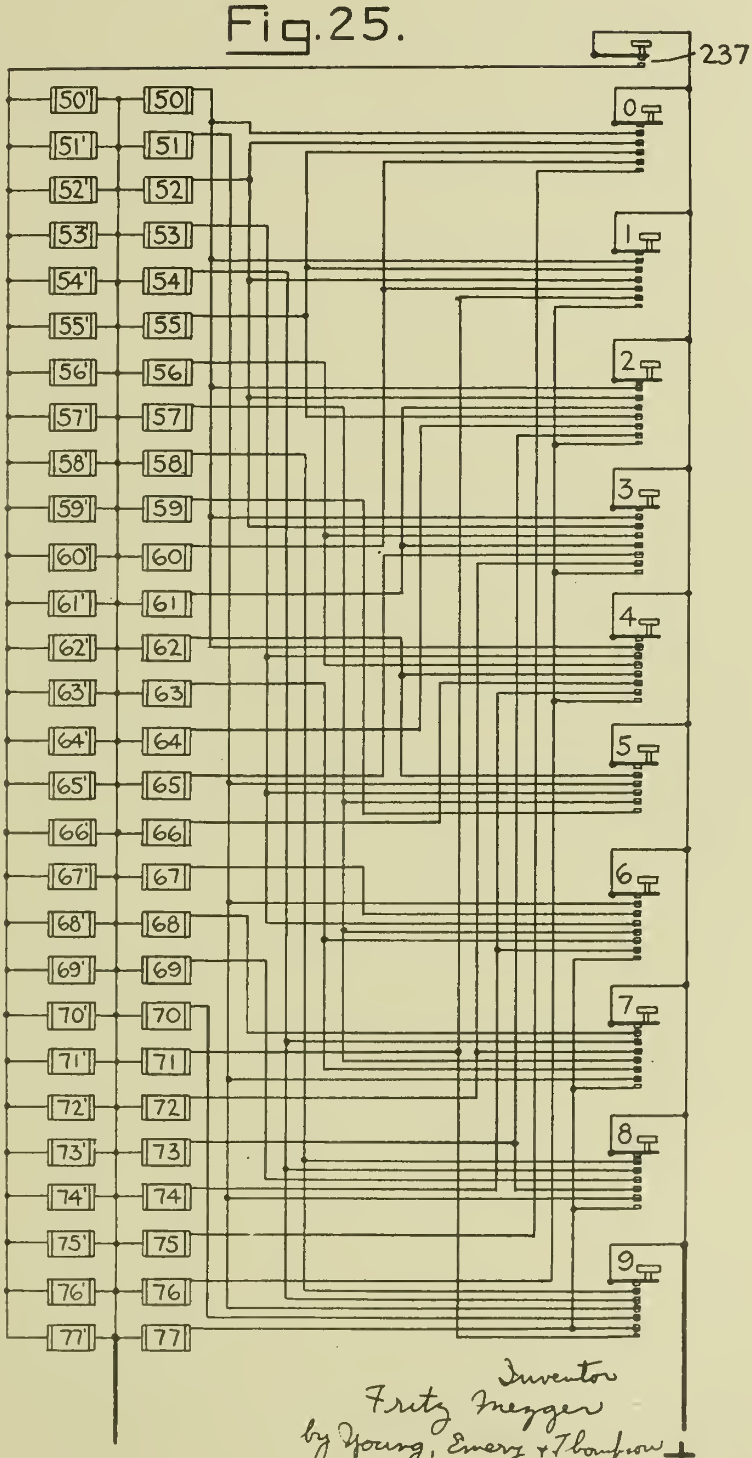
39 Sheets-Sheet 33

Fig. 25.



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Serial No.
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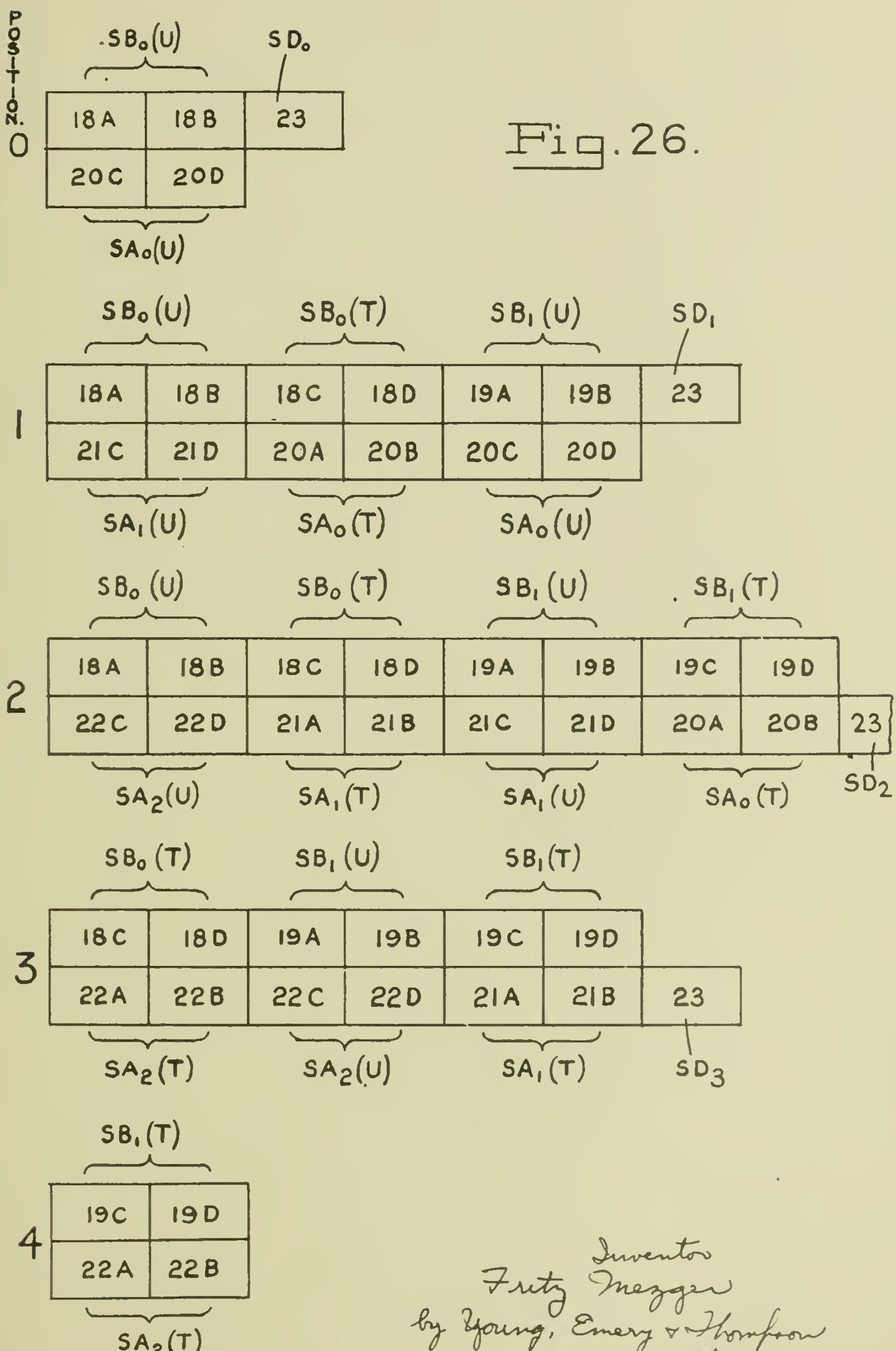
39 Sheets-Sheet 34

Fig. 26.



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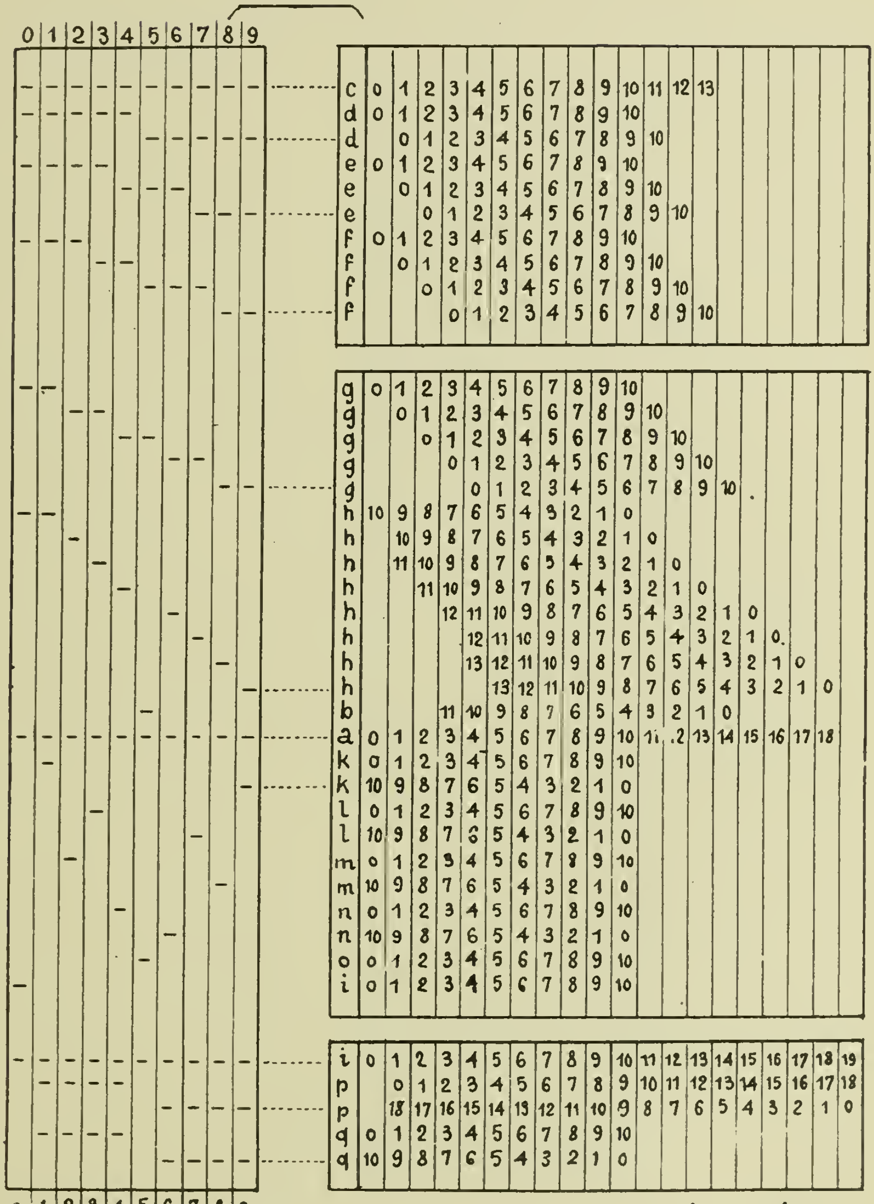
PROCESS AND DEVICE FOR ELECTRICAL CALCULATION

Filed May 24, 1938

Serial No. 209,832

39 Sheets-Sheet 35

Fig. 27.



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PROCESS AND DEVICE FOR
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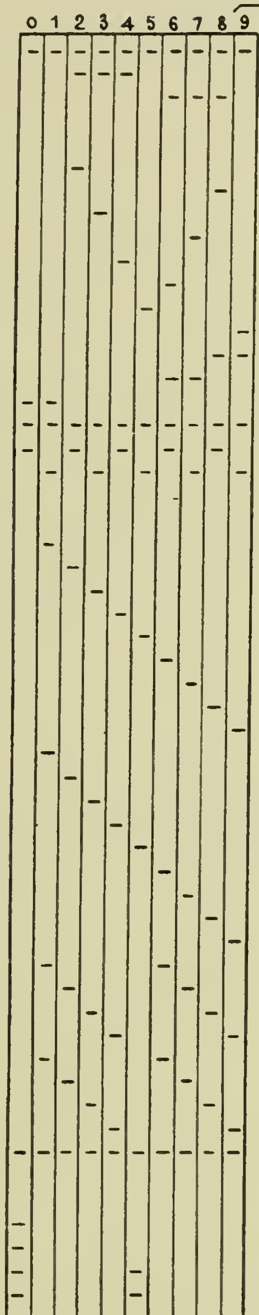
39 Sheets-Sheet 36

Fig. 28.



c	0	1	2	3	4	5	6	7	8	9	10	11	12	13					
a	0	1	2	3	4	5	6	7	8	9	10	11	12	13					
h	0	1	2	3	4	5	6	7	8	9	10	11	12	13					

d	0	1	2	3	4	5	6	7	8	9	10								
d	10	9	8	7	6	5	4	3	2	1	0								
e	0	1	2	3	4	5	6	7	8	9	10								
e	10	9	8	7	6	5	4	3	2	1	0								
f	0	1	2	3	4	5	6	7	8	9	10								
f	10	9	8	7	6	5	4	3	2	1	0								
g	0	1	2	3	4	5	6	7	8	9	10								
h	10	9	8	7	6	5	4	3	2	1	0								
b	10	9	8	7	6	5	4	3	2	1	0								
b	11	10	9	8	7	6	5	4	3	2	1								
a	0	1	2	3	4	5	6	7	8	9	10								
i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
o	0	1	2	3	4	5	6	7	8	9	10								
o						0	1	2	3	4	5	6	7	8	9	10			

k	0	1	2	3	4	5	6	7	8	9	10								
k		0	1	2	3	4	5	6	7	8	9	10							
k			0	1	2	3	4	5	6	7	8	9	10						
k				0	1	2	3	4	5	6	7	8	9	10					
k					0	1	2	3	4	5	6	7	8	9	10				
k						0	1	2	3	4	5	6	7	8	9	10			
k							0	1	2	3	4	5	6	7	8	9	10		
k								0	1	2	3	4	5	6	7	8	9	10	
k									0	1	2	3	4	5	6	7	8	9	10
l			0	1	2	3	4	5	6	7	8	9	10						
l						0	1	2	3	4	5	6	7	8	9	10			
l									0	1	2	3	4	5	6	7	8	9	10
l		0	1	2	3	4	5	6	7	8	9	10							
l					0	1	2	3	4	5	6	7	8	9	10				
l								0	1	2	3	4	5	6	7	8	9	10	
l	0	1	2	3	4	5	6	7	8	9	10								
l				0	1	2	3	4	5	6	7	8	9	10					
l							0	1	2	3	4	5	6	7	8	9	10		
m		0	1	2	3	4	5	6	7	8	9	10							
m				0	1	2	3	4	5	6	7	8	9	10					
m						0	1	2	3	4	5	6	7	8	9	10			
m								0	1	2	3	4	5	6	7	8	9	10	
n				0	1	2	3	4	5	6	7	8	9	10					
n								0	1	2	3	4	5	6	7	8	9	10	
n		0	1	2	3	4	5	6	7	8	9	10							
n						0	1	2	3	4	5	6	7	8	9	10			
p	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

k	0	1	2	3	4	5	6	7	8	9	10								
l	0	1	2	3	4	5	6	7	8	9	10								
m	0	1	2	3	4	5	6	7	8	9	10								
n	0	1	2	3	4	5	6	7	8	9	10								
q	0	1	2	3	4	5	6	7	8	9	10								

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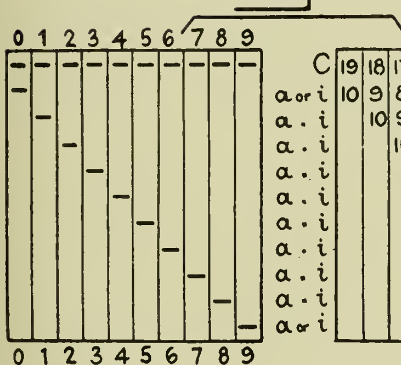
Fig. 29.



C	19	18	17	16	15	14	13	12	11	10	0	1	2	3	4	5	6	7	8	9
a or i	10	9	8	7	6	5	4	3	2	1	0									
a . i		10	9	8	7	6	5	4	3	2	1	0								
a . i			10	9	8	7	6	5	4	3	2	1	0							
a . i				10	9	8	7	6	5	4	3	2	1	0						
a . i					10	9	8	7	6	5	4	3	2	1	0					
a . i						10	9	8	7	6	5	4	3	2	1	0				
a . i							10	9	8	7	6	5	4	3	2	1	0			
a . i								10	9	8	7	6	5	4	3	2	1	0		
a . i									10	9	8	7	6	5	4	3	2	1	0	
a or i										10	9	8	7	6	5	4	3	2	1	0

Fig. 30.

Interval	SA2		SA1		SA0		SB0		SB1		
	ao	io	ao	io	ao	io	io	ao	io	ao	
0 a						–	–				
b						–	–				
1 a				o	–	+	o	–	+		
b				o	–	+	o	–	+		
2 a		/	o	–	+		/	o	–	+	
b		/	o	–	+		/	o	–	+	
3 a	/	o	–					/	o	–	
b	/	o	–					/	o	–	
4 a	o									o	
b	o									o	
0 a						–	–				
b						–	–				
1 a				o	–	+	o	–	+		

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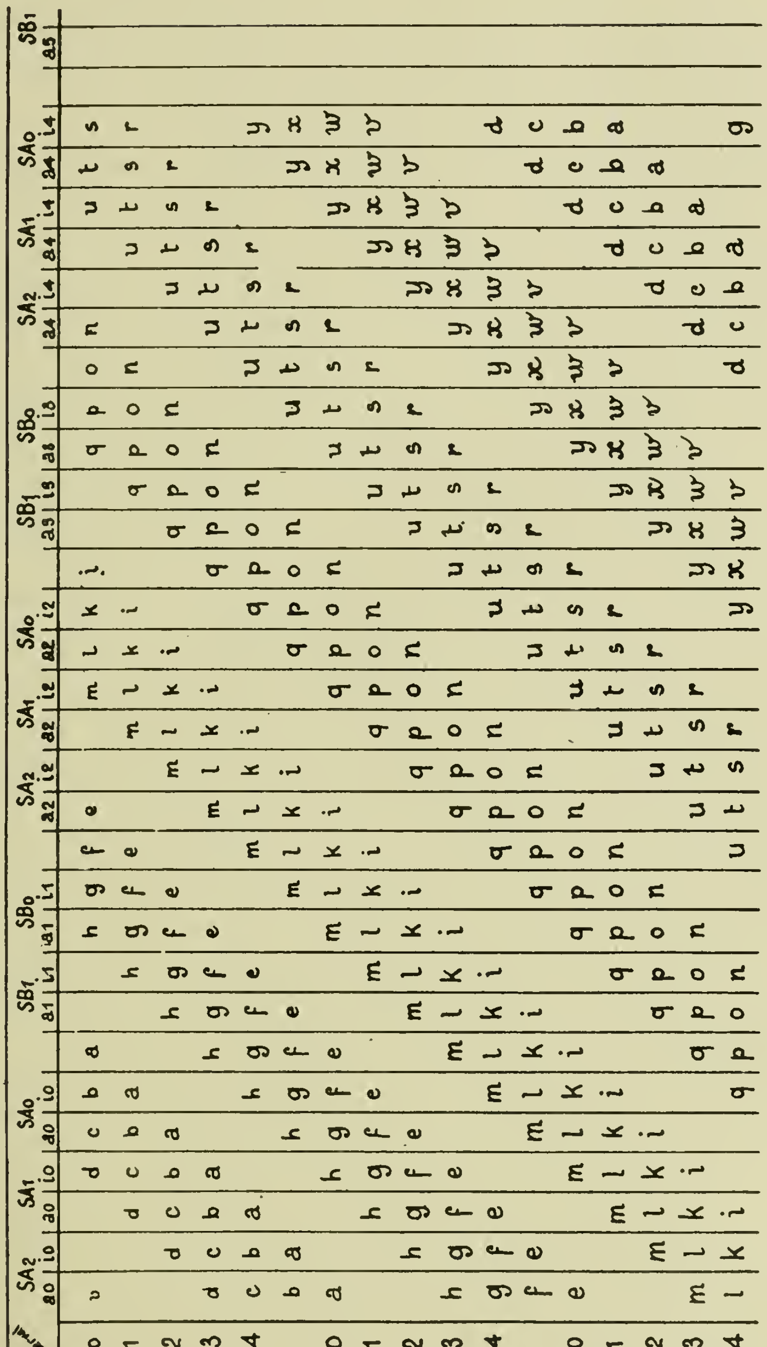

Fig. 31A.

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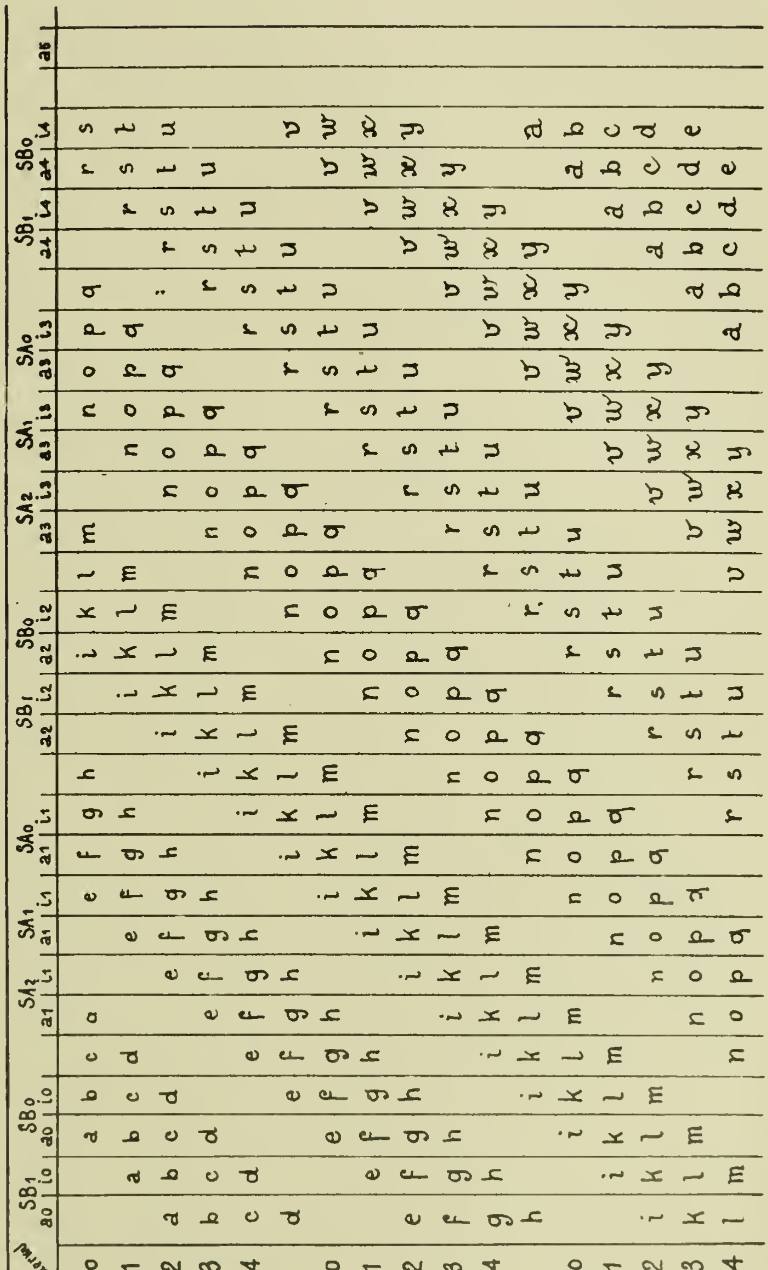

Fig. 31B.

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ALIEN PROPERTY CUSTODIAN

ELECTRIC CIRCUIT BREAKERS WITH COMPRESSED FLUID BLOW OUT

Bernard Marie Hilaire Paul Fernier, Lyon, France; vested in the Alien Property Custodian

Application filed June 18, 1938

This invention relates to electric circuit breakers with compressed fluid blow out and has for one of its objects to provide an improved circuit breaker of the aforesaid type.

Circuit breakers of this general type, and more particularly pneumatic circuit breakers for high tension currents are known in which the fixed contact of the arc drawing device is positioned within a tubular member through which the blast is supplied; when the contacts are in closed position, in order normally to prevent passage the electric current across the end surfaces of the contacts to which the arc is connected, the current arriving from the terminal of the fixed contact of said arc-drawing device is generally supplied to the movable contact of said device through lateral contact brushes located within said tubular member.

With such an arrangement however, in the case of high intensity circuit breakers, large contacts and a tubular member of large dimensions are required, but in such case the blast would not be very efficacious. One of the objects of the present invention is to overcome this difficulty.

Another object of the invention is to provide an electric circuit breaker with compressed fluid blow out, in which the main contacts are disposed about the contacts of the arc-drawing device, said main contacts or at least those positioned about the fixed contact being outside of the blast current which latter is directed from the fixed contact of the arc-drawing device toward the movable contact of said device, said fixed contact of the arc-drawing device being always positioned within an insulating tubular member serving as a conduit for the blast.

The invention and its objects above set forth as well as others which may hereinafter appear, will be clearly understood from the following description, taken in connection with the accompanying drawing of several embodiments of the invention herein given for illustrative purposes, the true scope of the invention being more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is a view, partly in section, of a circuit breaker embodying an illustrative form of the invention, the contacts of the arc-drawing device being in closed position and the fixed contact of said device being mounted upon a spring;

Fig. 2 is similar to Fig. 1, but shows the contacts of the arc-drawing device in separated or open position;

Fig. 3 shows a modification of the embodiment shown in Fig. 1, the movable contact of the arc-drawing device being mounted upon a spring;

Fig. 4 is similar to Fig. 3, but with the contacts of the arc-drawing device in separated or open position;

Fig. 5 is a view, partly in section, of a circuit breaker embodying another embodiment of the invention, in which both the movable and the fixed contact of the arc-drawing device are mounted upon springs;

Fig. 6 is a view, partly in section, of a further embodiment of the invention;

Fig. 7 is a perspective view of a special form of one of the parts belonging to the movable contact of the circuit breaker;

Fig. 8 is a sectional view of a modification of the fixed contact of the arc-drawing device;

Fig. 9 is a view, partly in section of a circuit breaker in which the fixed contact of the arc-drawing device is of the type shown in Fig. 8, both contacts of said device being in closed position; and

Fig. 10 shows a modification of the construction shown in Fig. 9.

Referring more particularly to Fig. 1, the fixed portion of the circuit breaker is mounted upon a hollow insulator 1 through which the blast is applied. Said blast may be of any suitable fluid, compressed air being herein used. The arc-drawing device comprises two relatively movable contacts; herein one of said contacts is fixed and the other is movable toward and from said fixed contact. The fixed contact 2 is located substantially on the longitudinal axis of a tubular member 3 having converging walls 4 of insulating material, said contact 2 having its end surface level with said converging surfaces during the blowing of the arc, so that the latter at the moment it is blown will be in the best position for extinction. In accordance with the invention the main contacts consist of spring pressed contact brushes 5 and are provided outside of said tubular member. The movable contact of the arc-drawing device is shown at 6 and includes a metal tube 7 which forms a main contact surrounding said movable contact 6, said tube engaging beneath the spring pressed contact brushes 5 and surrounding the tubular member 3, when the contacts 2 and 6 are moved into closed position.

It is desirable that the contacts shall possess a low electro-dynamic repulsion, particularly in the case of circuit breakers with high rupturing power. To this end the fixed contact 2 may be resiliently mounted, for example, by being backed

up by a relatively strong spring 8 to exert a strong pressure or thrust toward the movable contact 6 at the moment of closure of said contacts (Fig. 1). Upon separation of said contacts (Fig. 2) said spring will bring said contact 2 into the most favorable position for the blast. Said spring by its action always enables the tube 7 to be disengaged from said spring pressed contact brushes 5 before the separation of the contacts 2 and 6.

In accordance with the invention the movable contact 6 may be resiliently mounted instead of the fixed contact 2 (Figs. 3 and 4), for example by means of an abutting spring 9 which can thus move said contact 6 substantially axially of said contact tube 7. Said spring 9 abuts at one end against the bottom 10 of said tube 7 and at its other end against an abutment 11 secured to one end of said contact 6 and having a sliding fit in said tube 7, said abutment engaging a fixed stop 12 within said tube when said contacts 2 and 6 are in open or disengaged position, said contact 6 having a sliding fit in said stop 12. The current is supplied to said tube 7 through spring pressed contact brushes 13, a blade 14 serving electrically to connect said tube and said contact 6. Said spring 9 will be compressed when said contacts 2 and 6 are engaged or in closed position and will expand during the separation of said contacts (see Figs. 3 and 4 respectively).

In accordance with the invention both the fixed contact 2 and the movable contact 6 may be spring pressed, each as above described, and as shown in Fig. 5. This arrangement has the advantage of reducing the stress upon spring 8 and the stroke of said contact 2. Said springs 8 and 9, or either of them, could also be replaced by suitable electro-magnetic or electro-dynamic means, whereby to ensure compensation of the electro-dynamic stresses.

The movable contact tube 7 need not necessarily have continuous or solid walls, as above described but may have its walls slotted or provided with openings to reduce weight or to cause it to conform to any shape that may be given to said tubular member 3; it may for example consist of a plurality of spaced parallel members 20 (Fig. 7) which may serve as guides and electrical conductors and which are joined at their ends adjacent the fixed contact 2, to an annulus or ring 21 which surrounds said tubular member 3 and is positioned under the contact brushes 5, when said contacts 2 and 6 are brought into closed position.

It will be apparent to those skilled in the art that said brushes 5, while being outside the tubular member 3 could be so positioned as to engage the interior surface of said movable contact tube 7 at the end of the relative movement of said contacts 2 and 6 to closed position, instead of being outside said contact tube 7 as previously described. Such a construction is shown in Fig. 6.

In the illustrative embodiments above described, the compressed fluid (gas or liquid) enters the tubular member 3 axially thereof, and the corresponding main contacts 5 are outside of said member. Figs. 8 and 9 show modified constructions in which 31 indicates one of the contacts of the arc-drawing device, 32 indicates the converging walls and 33 indicates the sleeve through which the blast of compressed fluid is supplied. Said contact 31 is provided with guides 34 and 35 and with fixed main contacts 36. Said guides 34 extend about said main contacts 36 to form a covering 34*a* contained entirely within the non-convergent portion of said tubular member. As the blast of compressed fluid arrives through said lateral sleeve 33 at the bottom of said covering 34*a*, and preferably at the point where the convergent portion of said tubular member starts, the blowing of the arc retains its full efficiency. Said contact 31 of the arc-drawing means abuts against a strong spring 37 to enable it to have a certain degree of mobility longitudinally, said spring being free from tension when the contacts of the arc-drawing device are not in contact (Fig. 8) and is tensioned when they are in contact (Fig. 9). This spring is useful in that it compensates the stresses of electro-dynamic repulsion to which said contacts are subjected when they are in contact. On the other hand it enables the end surface 38 of said contact 31 to be disengaged as much as possible at the moment of separation of the contacts of said arc-drawing device, whereby the blowing operation by compressed gas is improved. When the contacts of the arc-drawing device are engaged (Fig. 9), the movable contact 39 of said device engages between the main contacts 36, while the tube 40, positioned about said movable contact, surrounds said tubular member 3*a*, said tube 40 being provided with a slot 41 into which the compressed fluid supply pipe 4*a* enters during the operation. In this case the tube 40 may with advantage be made of insulating material and in fact may be dispensed with. Such a construction is shown in Fig. 10. In the construction shown in Fig. 9, however, the blowing of the arc will be more efficacious if a continuous passage, such as tube 40, be provided for the compressed fluid. Electro-magnetic or electro-dynamic compensating means may be added to the compensating spring to reenforce the action of the latter.

The invention has been described mainly in its application to pneumatic circuit breakers in which the fixed contact of the arc-drawing device is disposed under the best conditions for the blowing of the arc at the moment of separation of the contacts of said device. It will be apparent that the invention may include a tubular member of any suitable shape, the fixed contact of the arc-drawing device occupying any desired position relatively to said member. Compressed air or any other suitable compressed gas or liquid may be used. Oil has been used with success.

I am aware that the invention may be embodied in other specific forms without departing from its spirit or essential attributes, and I therefore desire the present embodiments to be considered in all respects as illustrative and not restrictive.

BERNARD MARIE HILAIRE
PAUL FERNIER.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

B. M. H. P. FERNIER

ELECTRIC CIRCUIT BREAKERS WITH
COMPRESSED FLUID BLOW OUT

Filed June 18, 1938

Serial No. 214,489

2 Sheets-Sheet 1

Fig. 1

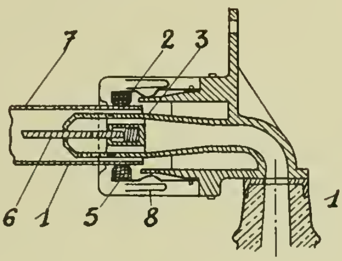


Fig. 2

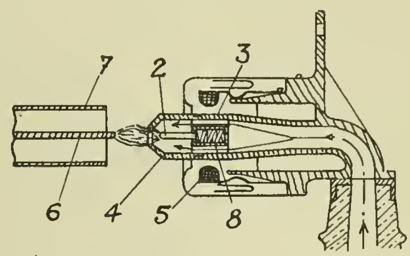


Fig. 3

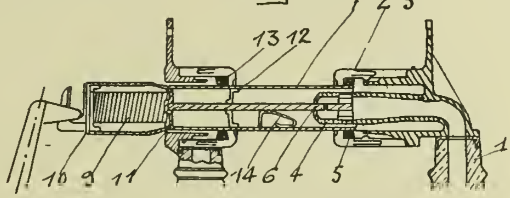


Fig. 4

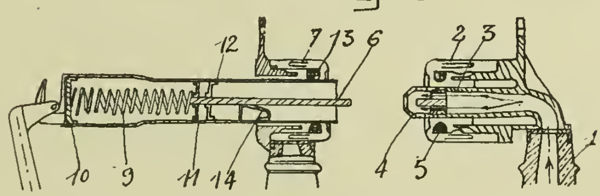


Fig. 5

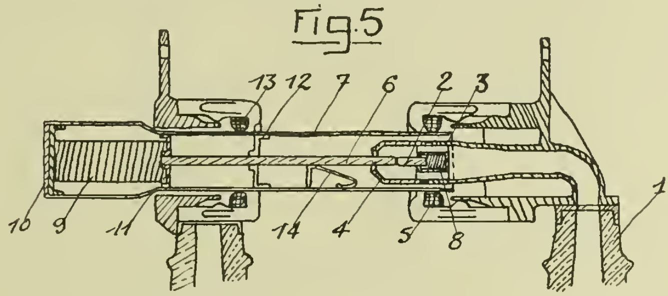


Fig. 6

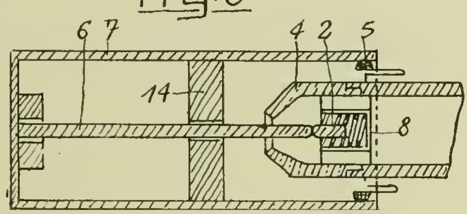
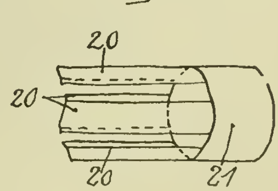


Fig. 7



Inventor

Bernard Fernier

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

B. M. H. P. FERNIER
ELECTRIC CIRCUIT BREAKERS WITH
COMPRESSED FLUID BLOW OUT
Filed June 18, 1938

Serial No.
214,489

2 Sheets-Sheet 2

Fig. 8

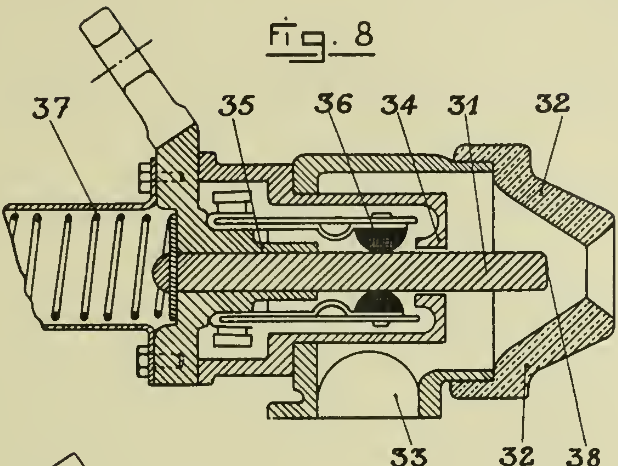


Fig 9

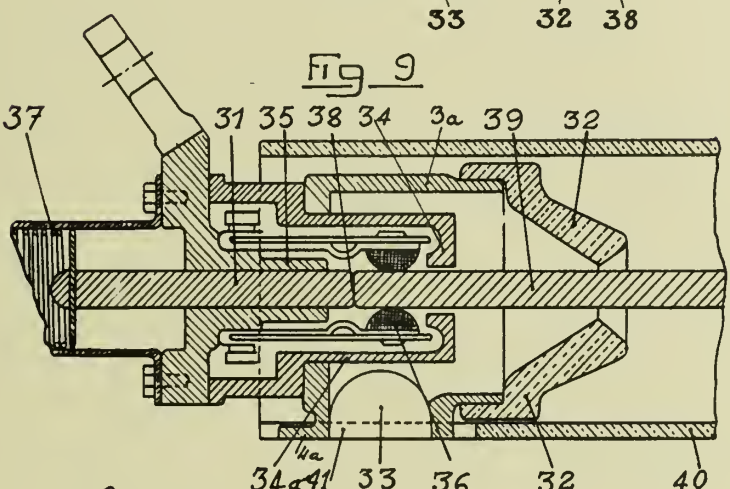
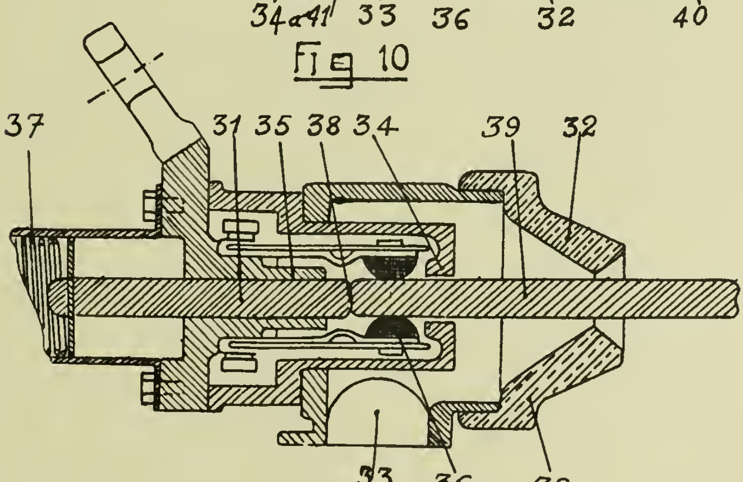


Fig 10



Inventor

Bernard Fernier

Published June 8, 1943

Serial No. 218,848

ALIEN PROPERTY CUSTODIAN

ELECTRIC CABLES

Charles Murray Beckett, Newcastle-on-Tyne, England; vested in the Alien Property Custodian

Application filed July 12, 1938

This invention relates to electric cables of the type manufactured by a drawing or rolling or other mechanical lengthening treatment from a work-piece comprising two or more conducting cores separated from a surrounding metallic sheath by insulating material such for example as powdered magnesia or steatite.

The object of the present invention is to provide satisfactory means for distinguishing from one another the several conductors in a cable of the kind referred to. The methods normally adopted in the case of ordinary cables are not readily applicable. For example it would not be practicable to wind textile threads of distinctive colours around the individual conductors since such threads would be destroyed during the mechanical lengthening treatment.

According to the present invention the various parts of the cable, at any cross-section thereof, are asymmetrically arranged in respect of their cross-sectional shapes or their relative positions or of the materials used so that the individual conductors of the cable can be readily distinguished from one another.

The materials of the cable may comprise simply those of the normal conductors and sheath and of the insulation. Thus in one simple form of the invention the cable comprises two or more conductors of different cross-sectional shapes so that the conductors can be distinguished by their cross-section. The cable may have two or more conductors of the same cross-section and one or more other conductors of different cross-section from these first conductors, the conductors of the same cross-section being distinguishable from each other by their position in relation to the conductor or conductors of another cross-section.

Alternatively the materials of the cable may include one or more additional materials, for example a rod or core of ductile material, such as a metal different from the metal of the remaining conductors. Such a rod may either be provided purely for the purpose of enabling the conductors to be distinguished by their position in relation to it or it may also serve as an additional conductor. For example a number of conductors of copper might be employed in conjunction with one conductor of aluminium of appropriate section for the current it is to carry, the aluminium conductor serving to differentiate the remaining conductors from one another by their positions in relation to it.

The invention may be carried into effect in various ways depending on the particular circumstances and conditions to be fulfilled. It is particularly applicable to electric cables manufactured by the preferred process described in the specifications of British Patents Nos. 471,935 and 472,159 and in the specification of the British Patent Application No. 19,505 of 1937.

In such preferred process powdered magnesia is first compressed to form blocks having external dimensions to fit the sheath of the work-piece and bored with holes to fit around the core or cores thereof. The compressed blocks are then heated in a high temperature furnace to expel all traces of water (whether water in suspension or water of crystallisation or water chemically combined in the material). The compressed dehydrated blocks are then inserted into the sheath of the work-piece around the conducting cores therein (or around one of such cores, the remaining cores being afterwards inserted into the holes in the blocks in the work-piece), and the whole is submitted to a drawing or rolling or other mechanical lengthening treatment to bring it to its final dimensions. The first stage of such treatment serves to reduce the blocks into the form of a homogeneous and isotropic powder which completely fills the space within the sheath, so that in the subsequent stages of the treatment the lengthening of the parts of the work-piece takes place homothetically, i. e. as though the whole work-piece were composed throughout of a single ductile metal.

Various constructional examples of cables, each embodying the invention, are shown in cross-section in the accompanying drawings. In Figures 1 and 2 the conducting cores are distinguished entirely by their cross-sectional shape, the cores being otherwise symmetrically disposed. Thus, in Figure 1, a hexagonal core A and a round core A^1 are separated from the sheath B by insulating material C, formed for example of blocks of magnesia as above indicated. Figure 2 shows a three-core cable in which one core D is hexagonal, whilst a second core D^1 is oval and a third core D^2 is round.

In the case of cables having three or more conducting cores the differentiation of certain of them may be achieved by their position in relation to other cores. For example, as shown in Figure 3 one conducting core E is rectangular whilst each of the other two cores E^1 and E^2 is round, the cores E^1 and E^2 being distinguished from one another by their position in relation to the rectangular core E. Where permissible the sections of the conducting cores may be of different sizes though of the same shape. One such arrangement is shown in Figure 4 in which all

the cores F, F^1 and F^2 are round but the core F is smaller in cross-section than the cores F^1 and F^2.

According to another arrangement, one or more of the conducting cores may be of a different material from the other core or cores. For example, in Figure 5 one core G of aluminium is employed in conjunction with two other cores G^1, G^2 of copper. In yet a further arrangement one or more pairs of concentric cores may be employed, the other cores being distinguished by their position in relation to the concentric pair or pairs. One such arrangement is shown in Figure 6 in which a concentric conducting core H is employed in conjunction with two single cores H^1, H^2. The current carrying cores may in some instances be all of the same size and section and a datum rod or core may be introduced into the cable to enable the conducting cores to be differentiated by their position in relation to the datum core. In Figure 7 the three current carrying cores J, J^1 and J^2 are all of the same cross-sectional size and shape, and a datum core J^3 is introduced for enabling the three conducting cores to be distinguished. Although not called upon to carry current the core J^3 may be of conducting material, for example a thin wire of the same material as the cores J, J^1 and J^2 and sheath B, the wire being situated close inside the sheath.

Instead of or in addition to asymmetrical arrangement of the cores, the sheath itself may be of asymmetrical cross-section so as to render the cores distinguishable by their position in relation to the sheath. One such arrangement is shown in Figure 8 in which the three cores K are separated by the insulation C from a sheath K^1 whose cross-section is of asymmetrical triangular shape.

Various arrangements may be employed for differentiating cores by their position in relation to a recognisable core. For example, as shown in Figure 9 five cores L are arranged on one and the same pitch circle concentric with the cable axis and may be counted in rotation from a sixth or datum core L^1 which is recognisable by its peculiarity of material, e. g. aluminium. According to the modification shown in Figure 10 a datum core M is recognisable by its distinctive shape. In Figure 11 a datum rod or core N is arranged outside the pitch circle of the six current carrying cores N^1. In Figure 12 all the conducting cores are of the same cross-section and are symmetrically arranged on one and the same pitch circle. The sheath M, however, has a groove M^1 so that the cores M^2 can be distinguished by their positions relatively to the said groove.

In some arrangements the conducting cores may all be of the same section and may be differentiated entirely by their arrangement within the sheath. For example, as shown in Figure 13, five conducting cores P are arranged on one and the same pitch circle but an increased gap is left between two of the cores so that the conducting cores can be identified by their positions relatively to the gap. In Figure 14 the four conducting cores R are located relatively to one another in the manner adopted for the pins of a thermionic valve.

Though in some constructions, for example such as those above described with reference to Figures 1 and 2, the different formation of the conducting cores will ensure identification of the several cores when viewed at either end of the cable, it is desirable where two or more cores have the same cross-sectional shape and size, to dispose the cores asymmetrically with respect to all diameters of the cable and thus ensure ready identification at either end of the cable. For example, in each of Figures 3 to 7 the datum core is somewhat nearer to one than to any other core. Similarly, in Figure 8 two of the cores are nearer to one another than to the third core.

Where the conducting cores are identified by counting round a ring from a given datum core or mark, it will be necessary to count in a clockwise direction at one end of a given piece of cable and in the anticlockwise direction at the opposite end. This difficulty may be overcome by asymmetrical arrangement of the datum core or mark. For example, in Figure 9 the datum core is asymmetrically disposed with respect to the other cores, whilst in Figure 10 the datum core is itself of asymmetrical formation so that its apex can be employed to indicate the direction in which the cores are to be counted for the purposes of differentiation, and in Figure 11 the datum core or rod is arranged nearer to one conducting core than to any of the others. Similarly in Figure 12 the datum mark or groove is nearer to one conducting core than to any of the others.

It will be understood that the several methods of distinguishing the conducting cores described above may be combined in various combinations so as, for example, to enable certain conductors which would not be distinguished by one method to be distinguishable by another.

In all the arrangements indicated and described the necessary provisions as to the relative cross-sections and positions of the cores are made in the work-piece, the holes in the compressed blocks having the appropriate shapes and spacings, and the preferred process above described is such that the relative positions of the cores are accurately reproduced on a reduced scale in the finished cable and, where cores of special cross-sectional shape are employed, the shape is retained to a degree sufficiently different from that of the other cores to enable it to be distinguished by feel or sight, or if necessary by gauge. Where insulating bushings are used to separate the conductors at the ends of the cable, means may be provided as by marking, colouring or shaping the bushes, to enable the conductors of special section to be quickly identified without examination of the ends of the conductors themselves. This will be advantageous in cases where the end of the conductor itself is covered with a cable eye or may become unrecognisable with handling.

CHARLES MURRAY BECKETT.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

C. M. BECKETT
ELECTRIC CABLES
Filed July 12, 1938

Serial No.
218,848

Fig_1

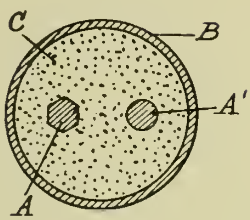


Fig_2

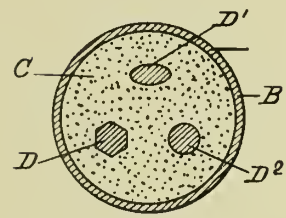


Fig_3

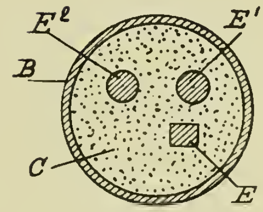


Fig_4

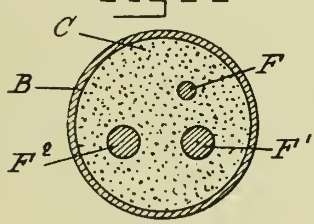


Fig_5

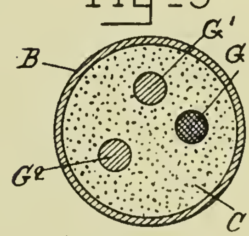


Fig_6

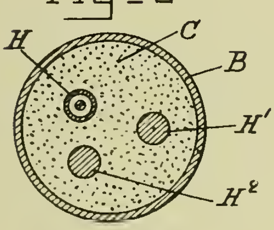


Fig_7

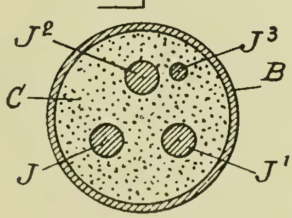


Fig_8

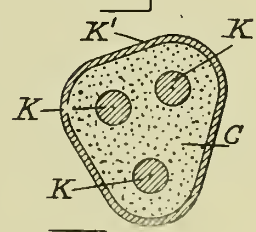


Fig_9

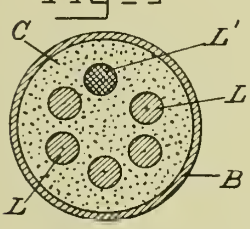


Fig_10

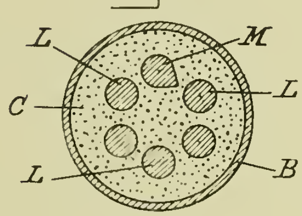


Fig_11

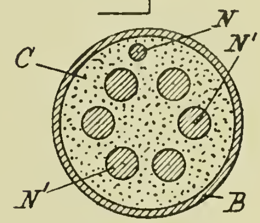


Fig_12

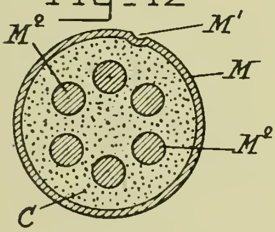


Fig_13

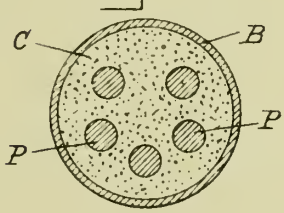
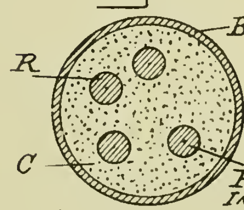


Fig_14



INVENTOR
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BY E. F. Wenderoth
ATTORNEY

Published June 8, 1943

Serial No. 222,535

ALIEN PROPERTY CUSTODIAN

COCCOCIDAL COMPOUNDS

Arnold Salomon, Oss, Holland; vested in the Alien Property Custodian

No Drawing. Application filed August 1, 1938

This invention relates to new compounds with coccocidal action.

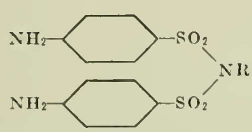
It is an object of the invention to provide new and useful derivatives of p.aminobenzene-sulfonamide such derivatives being soluble in water to a considerable extent.

It is well known that p.aminobenzene-sulfonamide is only sparingly soluble in water. Hence large volumes of its aqueous solution have to be injected in order to apply the necessary doses.

While injecting the new compounds the volume of solution can be considerably reduced.

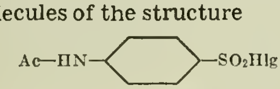
The new products can be obtained by the process which forms an object of the invention too and which is to be described hereafter.

I have found that substances of the general formula



have the properties indicated above. In this formula R stands for a group from the class comprising H, alkyl, an isocyclic and a heterocyclic ringsystem.

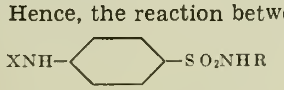
These new compounds are prepared by causing two molecules of the structure



Ac standing for an acyl group and Hlg for a halogen, to react with one molecule of a substance having the general formula H_2NR, in which R stands for a group from the class comprising H, alkyl, an isocyclic and a heterocyclic compound.

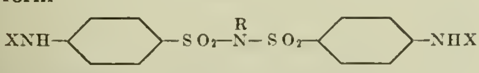
It is supposed that the reaction proceeds in two steps. In the first step one of the two hydrogen atoms in the H_2NR molecule is substituted, whereas in the second step the second hydrogen atom is substituted. In both steps the substitution is caused by the splitting off of hydrogen halide from the reacting molecules.

From the foregoing it follows that the first step can be avoided by taking as a starting material the product of this first step, which product is p.aminobenzene-sulfonamide or one of its acyl derivatives. Hence, the reaction between



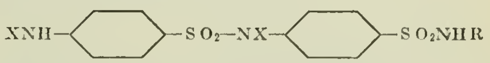
and

to form



falls within the scope of my invention. [Ac, X and R have the same meaning as stated above].

In carrying out the condensation with unacylated p.aminobenzene-sulfonamide, thus X being H, the reaction may take a different course, products of the general formula



being formed.

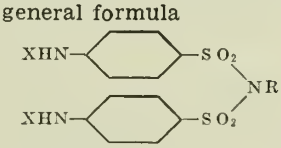
If it is desired to avoid the formation of these by products one may either start with p-acyl derivatives of p.aminobenzene-sulfonamide, in which case the amino group is protected against substitution, or carry out the reaction in an alkaline solution. I have found that in alkaline solutions the formation of by products is reduced to a great extent.

The new compounds have excellent coccocidal properties.

During the reaction generally the acyl groups are subsequently saponified.

It is a further object of my invention to provide neutral solutions of derivatives of p.aminobenzene-sulfonamide. It is well known that p.aminobenzene-sulfonamide itself is only soluble in acid solutions. Some of the new compounds obtained by the process of this invention, however, have the property of forming soluble alkali salts.

If in the general formula



R=H, this hydrogen atom can be substituted by an alkali metal. The solutions of these alkali salts can easily be adjusted to pH 7,2, the pH of normal blood. The sodium salts are especially well suited for injection. The salts have the same therapeutic value as the substances themselves.

In order to facilitate a clear understanding the following examples are given.

Example 1.—40 g of p.aminobenzene-sulfonamide are suspended in 200 cc of sodiumhydroxide of 25% strength. To the suspension, which is continuously stirred, 60 g of p.acetylamino-benzene-sulfonylchloride are added in small portions. Condensation takes place with evolution of heat the hydrochloric acid liberated being neutralized by the sodium hydroxide. After the reaction has slowed down the reaction mixture is further heated for half an hour on a steam bath. After cooling part of the di-[p.amino benzene-sulfonyl] amide-sodium crystallizes; it is filtered with suction. From the mother liquor a further crop is precipitated with ethanol. Yield: 80% of the theoretical yield.

The product can be purified by recrystallisation from ethanol. In this way white needles are obtained which are easily soluble in water to at

least 20%. The pH of such a solution may be adjusted to 7,2.

Example 2.—25 g of p.acetylamino-benzene-sulfonamide, 25 g of p.acetylamino-benzene-sulfonylchloride and 140 cc of water are boiled with reflux for one hour. The acid reaction mixture is cooled down. 7 g of p.acetylamino-benzene-sulfonamide crystallize and are recovered. After neutralisation of the filtrate another 13 g crystallize and after evaporation of a large part of the solvent once more a quantity of 7 g p.acetylamino-benzene-sulfonamide is obtained. The filtrate is now evaporated to dryness.

The residue is recrystallized from ethanol. Yield 7 g of a compound which is supposed to be di-[p.amino-benzene-sulfonyl] amide.

Example 3.—23 g of p.acetylamino-benzene-sulfonamide are boiled under reflux for one hour with 100 cc of water and 4 cc of 25%ic ammonia. The liquid reacts as acid with respect to congo and is therefore neutralized with sodium-carbonate. The solution is evaporated on a steam bath and the residue recrystallized from ethanol. Yield 7 g.

The acetyl groups appear to have been split off during the reaction.

ARNOLD SALOMON.

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ALIEN PROPERTY CUSTODIAN

CARBURETTORS FOR INTERNAL COMBUSTION ENGINES

Alexander Abramson, Prague, Czechoslovakia; vested in the Alien Property Custodian

Application filed August 11, 1938

This invention relates to carburettors for internal combustion engines of the kind having a mixing cross-section varying automatically in accordance with the quantity of air sucked in.

It is required of carburettors of the kind referred to that no fuel should issue through the atomising nozzle, arranged in the mixing chamber of the carburettor, during starting or periods of idle running of the engine. For starting and during idle running of the engine, fuel is supplied to the induction pipe from a separate starting or idle running nozzle. This arrangement has the disadvantage that when the throttle valve is suddenly opened the atomising nozzle, arranged in the mixing chamber of the carburettor does not begin immediately to operate since the fuel column must first be set in motion by the difference in pressure between the mixing chamber of the carburettor and the fuel container. Up to this time, however, so much air comes into the induction pipe of the engine that the fuel issuing from the starting nozzle which is still operating cannot form an ignitable mixture with it. Accelerating pumps have, therefore, been used, which cut out this critical phase in the operation of the engine by injecting the necessary quantity of fuel.

A further disadvantage is that on shutting off the engine the throttle valve retains its predetermined position in the induction pipe for starting or for idle running. Pressure equalisation between the spaces above and below the throttle valve can only take place, after some time has elapsed through the very narrow crescent-shaped slit then existing between the edge of the throttle valve and the wall of the induction pipe. During this time the relatively cooler air flows past the atomising nozzle through the mixing chamber into the induction pipe, thus continuously causing fuel to issue from the starting nozzle.

The object of the present invention is to overcome these disadvantages. In carburettors having a mixing cross-section varying automatically according to the quantity of air sucked in, it is known to provide in the mixing chamber of quadrangular cross-section a pivoted blade on each side of the transversely disposed atomising nozzle. These blades are provided for the exclusive purpose of opening out when the engine is loaded by the incoming air so as to be spaced more or less apart from the atomising nozzle in order to obtain in this way pressure conditions in the neighbourhood of the atomizing nozzle and in the mixing chamber which lead the desired predetermined quantity of fuel to the air.

According to the present invention the pivoted blades are used for a further purpose. In a carburettor according to the invention the starting or idle running nozzle is no longer used and in the neighbourhood of the atomising nozzle a flow cross-section for the air is obtained so that in the starting or idle running position of the carburettor throttle valve the drop in pressure prevailing in the mixing space permits the air to flow through the mixing space to such an extent that the fuel emerges from the atomising nozzle in a quantity which corresponds to the formation of a mixture ensuring starting or idle running. In this way on starting or during idle running the fuel will be found flowing in the ducts of the carburettor leading to the atomising nozzle, so that during transition of the engine operation to load and also to sudden maximum load the fuel emerges immediately in a requisite quantity from the atomising nozzle. Constructed devices which are provided according to the invention on the throttle valve of the carburettor serve in this connection for ensuring the formation of a complete starting or idle running mixture of fuel and air.

The invention also provides measures in order on shutting off the engine to effect as quickly as possible pressure equalisation in the spaces above and below the throttle valve and therewith to prevent the continued emergence of fuel under the action of inertia from the atomising nozzle. These measures consist therein that the throttle valve in the position in which it is adjusted obliquely to the axis of the induction pipe for starting and idle running is disposed adjacent to two edge recesses, replacing the previous crescent-shaped slits between the edge of the throttle valve and the wall of the induction pipe, or adjacent to recesses arranged in the wall of the induction pipe. Since these recesses are arranged at the highest and lowest positions of the obliquely disposed throttle valve, they determine at the same time the flow passages for far the greater part of the fluid flowing in a corresponding direction at the times indicated (starting and idle running or shutting off the engine), so that on the one hand the starting and idle running phase of the engine is favourably influenced, and on the other hand the most rapid equalisation in pressure in the spaces above and below the throttle valve is obtained on shutting off the engine.

The accompanying drawing illustrates constructional examples of the invention applied to a down draught carburettor.

Figs. 1 and 2 are vertical sections in two mu-

tually perpendicular planes of one constructional form, and

Figs. 3 and 4 illustrate separately a constructional form of throttle valve and its arrangement in the induction pipe in section and plan.

The down draught carburettor shown in the drawings is constructed on the principle that its mixing cross-section varies automatically according to the quantity of air sucked in. Accordingly, in the mixing chamber 5 of the carburettor, the blades 7 are pivoted around pins 6 which are pressed by springs 8 each one to one side of the transversely disposed atomising nozzle 9. On opening the throttle valve the air flowing against the blades 7 produces a movement of the blades away from the atomising nozzle, so that the flow cross-section through the mixing chamber varies in accordance with the air sucked in.

According to the invention the blades 7 with wide cut-out portions 10 of the atomising nozzle 9 determine in the starting or idle running position of the throttle valve 11 such a flow cross-section 12 for the starting or idle running phase of the engine, to be denoted as invariable, that the air flowing through it causes the proper quantity of fuel to issue from the atomising nozzle to form the starting or idle running mixture. The arrangement of a separate starting or idle running nozzle thus becomes superfluous. The fuel is thus, on starting or during idle running of the engine, in movement in the ducts leading from the float chamber 13 into the atomising nozzle, so that a transition from idle running to loading of the engine is effected without disturbance even in the case of sudden maximum loading.

The following arrangement is adopted for forming the inlet of air and fuel in the space below the throttle valve similarly to a nozzle, in order to obtain favourable conditions for the formation of the starting or idle running mixture.

The throttle valve 11 has on its periphery facing the engine a rib 14 projecting beyond the outer surface of the throttle valve, the rib having a through aperture 15. The device serves to guide the air striking the throttle valve in its starting or idle running position, and the fuel dropping out of the atomising nozzle 9, along the rib 14 against the aperture 15, operating in a nozzle-like manner, from which fuel and air emerges in a well mixed state.

In order to support this operation in the starting or idle running position of the throttle valve, according to the constructional examples illustrated in Figs. 3 and 4, the communication between the spaces above and below the throttle valve is produced merely by the edge recesses 16 and 17. The remaining periphery of the obliquely disposed throttle valve abuts against the wall of the induction pipe. The recess 16 is disposed below the aperture 15 in the rib 14 and the recess 17 is disposed diametrically opposite the recess 16. All fluid (air and fuel) which strikes on the upper surface of the throttle valve is directed along this surface of the throttle valve and along the rib 14 towards the recess 16. Much the greater part of the air which, on shutting off the engine, strives in consequence of the super-pressure prevailing in the induction pipe, to reach the space above the throttle valve, passes through the recess 17. Equalisation of the pressures in the spaces above and below the throttle valve takes place therefore considerably more rapidly than in the presence of the known crescent-like slits between throttle valve and wall of the induction pipe, (frictional resistance opposing the flow), which has for consequence an immediate interruption in the emergence of the fuel from the atomising nozzle on shutting off the engine.

The recesses 16, 17 can also have a variable flow cross-section, which can be obtained, for example, by the arrangement of adjustable slides on the throttle valve. Recesses corresponding to the recesses 16, 17 can also be arranged in the wall of the induction pipe.

ALEXANDER ABRAMSON.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

A. ABRAMSON
CARBURETTORS FOR INTERNAL COMBUSTION ENGINES
Filed Aug. 11, 1938

Serial No.
224,291

Fig. 1.

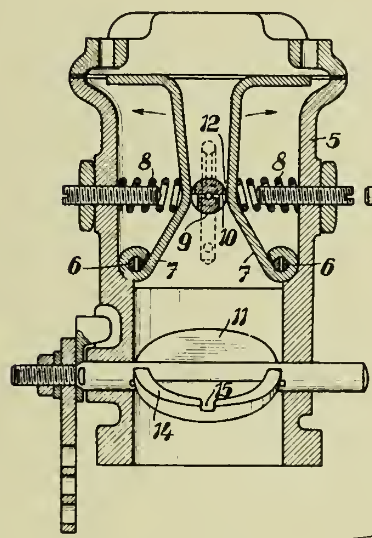


Fig. 2.

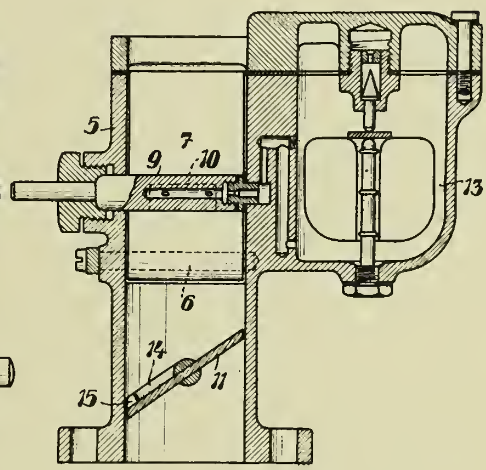


Fig. 3.

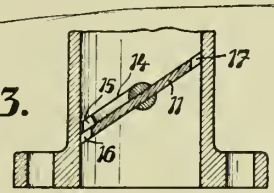
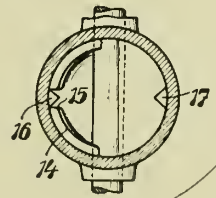


Fig. 4.



ALEXANDER ABRAMSON
INVENTOR

By Otto Munk
HIS ATT'Y.

Published June 8, 1943

Serial No. 224,292

ALIEN PROPERTY CUSTODIAN

CARBURETTORS FOR INTERNAL COMBUSTION ENGINES

Alexander Abramson, Prague XII, Czechoslovakia; vested in the Alien Property Custodian

Application filed August 11, 1938

This invention relates to carburettors for internal combustion engines.

Carburettors are known the mixing chamber of which has a flow cross-section which varies automatically according to the conditions in the induction pipe. The mixing chamber of such carburrettors is usually of quadrangular cross-section. Pivoted blades of rigid or elastic material are provided at two oppositely disposed walls of this mixing chamber. These blades are pivoted at their one end on a pin and the other end of these pivoted blades is free. The pivoted blades are spring pressed.

The pivoted blades abut, when the engine is running, idly against the atomiser, arranged transversely in the mixing chamber. When the throttle valve of the carburettor is opened the engine sucks a greater quantity of air which flows with greater velocity. The energy of the air flowing through the mixing chamber acts on the pivoted blades in such a way that these are moved away from the atomiser. Simultaneously the drop in pressure in the vicinity of the atomiser acts on the fuel which is disposed in the ducts and nozzles connected with the atomiser, so that the fuel begins to flow out of the atomiser into the induced air current.

A great defect of these known carburettors having a mixing chamber of variable flow cross-section is that the pivoted blades are built into the mixing chamber with the greatest accuracy, that is with a play which is as small as possible relatively to the walls of the mixing chamber. In many cases 0.005″ is prescribed for this play. This apparently correct precaution has for consequence that it is not at all possible to obtain both a favourable fuel consumption and also a trouble-free transition to the engine speed corresponding to sudden opening of the throttle valve of the carburettor. The cause of this is that by reason of the above mentioned accurate fitting of the pivoted blades in the mixing chamber when the energy of the air sucked in by the motor suddenly increases, (sudden opening of the throttle valve), the pivoted blades are moved with maximum velocity from the atomiser to the maximum possible distance from one another, whereby there immediately occurs a falling off in the velocity of the air sucked in by the motor, as well as in the drop in pressure associated therewith in the vicinity of the atomiser. Consequently a sudden interruption in the outflow of fuel from the atomiser and therefore also a momentary decrease in the speed of the engine takes place. Further, when the air passes exclusively in that space of the mixing chamber determined by the pivoted blades an economical fuel consumption is obtained only within very narrowly limited ranges of engine speed.

A carburettor, the mixing chamber of which has a non-variable flow section for the air sucked in by the motor, has the disadvantage that, for the purpose of obtaining a better fuel consumption, this flow cross-section must be enlarged, which impairs the volumetric effect of the engine because the cylinder charging of the engine is impaired when the flow velocity of the induced air drops, in the case that the invariable flow cross-section of the mixing chamber exceeds a predetermined limit.

The object of the present invention is to overcome these defects.

In a carburettor according to the present invention the air sucked in by the motor flows not only through the mixing space proper of the mixing chamber, but also in the same direction, partly through ducts which are disposed between the mixing space of the mixing chamber and the walls thereof.

The accompanying drawings illustrate how the invention may be carried into effect.

Figs. 1 and 2 are longitudinal sections in two mutually perpendicular planes and Fig. 3 a plan of a mixing chamber according to the invention provided with a variable flow cross-section.

Figs. 4 and 5 are respectively transverse and longitudinal sections of a mixing chamber provided with a non-variable flow cross-section.

In the mixing chamber 1 having a variable flow cross-section illustrated in Figs. 1 to 3, the pivoted blades 2 are pivotally mounted on rollers 3 and are pressed, when the engine is stationary and also when it is running idly, by springs 4 against the atomising nozzle 5. The space determined by the blades 2 disposed below the atomising nozzle 5 is the mixing space proper. The spaces 7 of the mixing chamber are disposed apart from the mixing space. Hitherto it has been attempted to prevent the penetration of air into these spaces 7. The air sucked in by the engine flows in the direction of the arrow c into the space 6 of the mixing chamber and, moving in the direction of the arrow d, reaches the induction pipe of the engine. The pivoted blades 2 are, according to the invention, so dimensioned that their width is smaller to the extent a than that of the mixing chamber 1 (Fig. 2). The air sucked in by the motor can penetrate through the ducts formed in this way into the spaces 7, being drawn off from these through apertures 8

in the blades 2 into the induction pipe of the engine. At the places where the blades 2 bear on the rollers 3 the usual play *b*, about 0.02 mm. relatively to the walls of the mixing chamber, is maintained. The width of the ducts *a* amounts to 1–4% of the width of the mixing chamber. The action of this arrangement is made effective because the induced air loses at all open positions of the throttle valve a part of its energy acting directly on the blades 2. The induced air will therefore, at a desired opening of the throttle valve, move the blades 2 away from the atomising nozzle 5 more slowly, so that fuel from the atomiser flows without interruption and in addition a constant drop in pressure is obtained in the neighbourhood of the atomising nozzle at each opening of the throttle valve of the carburettor. It is clear that as the velocity of the air flowing through the mixing chamber increases, a correspondingly larger part of this air passes along the path of smaller resistance (channels *a*). When the quantity of air flowing through the space 6 decreases the drop in pressure in the neighbourhood of the atomising nozzle 5 is relatively reduced, so that the quantity of induced fuel will be smaller than is the case with previous constructions of mixing chamber.

The advantage of the operation above described is utilised in mixing chambers with non-variable cross-section because the mixer previously inserted very accurately in the mixing chamber forms between the latter and the walls of the mixing chamber the characteristic auxiliary flow ducts for the induced air.

Accordingly the mixer 10 of the mixing chamber 9, which has an invariable cross-section, has a diameter which is correspondingly smaller than the diameter *d* of the mixing chamber, thereby providing the auxiliary flow ducts *a* (Figs. 4, 5).

The arrangement of the auxiliary flow ducts *a* can, in general, also be asymmetric to the axis of the mixing chamber.

ALEXANDER ABRAMSON.

PUBLISHED A. ABRAMSON Serial No.
JUNE 8, 1943. CARBURETTORS FOR INTERNAL COMBUSTION ENGINES 224,292
BY A. P. C. Filed Aug. 11, 1938

Fig. 1.

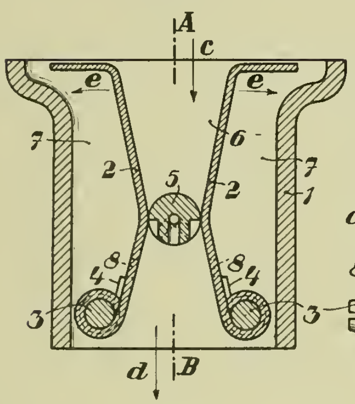


Fig. 2.

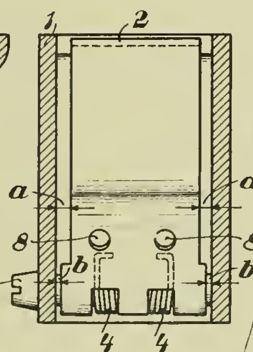


Fig. 4.

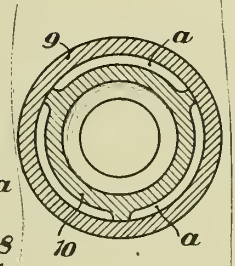


Fig. 5.

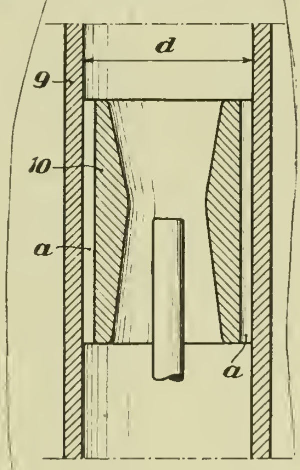
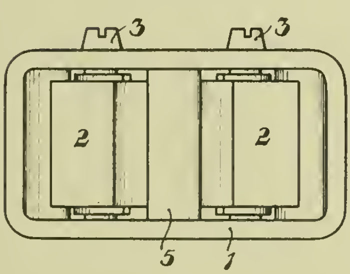


Fig. 3.



ALEXANDER ABRAMSON
INVENTOR

By Otto Munk
HIS ATT'Y.

Published June 8, 1943

Serial No. 225,586

ALIEN PROPERTY CUSTODIAN

PROCESS OF MAKING FILAMENTS CONSISTING OF PURE SILICIC ACID

Franz Skaupy, Berlin-Lichterfelde-West, and Gustav Weissenberg, Berlin-Mariendorf, Germany; vested in the Alien Property Custodian

No Drawing. Application filed August 18, 1938

This invention relates to the manufacture of filaments consisting of pure silicic acid, more particularly quartz.

Compared with glass filaments, filaments consisting of pure silicic acid, and more particularly those consisting of quartz, excel by their greater resistance to chemical influences and heat. They also excel by their extremely high electrical resistance and, particularly if subsequently vitrified, by their very small di-electric losses.

It is already known to make filaments consisting of pure silicic acid, and particularly quartz, by spinning fused silicic acid or quartz. This method is difficult to perform as it necessitates working at extremely high temperatures, quartz only melting at 1710° C.

According to the present invention filaments consisting of pure silicic acid, particularly quartz, are produced my making an intermediate filament from a compound containing silicic acid which is capable of being spun at considerably lower temperatures, this filament being subsequently freed from substances other than silicic acid by chemical action, whereby a filament consisting of pure silicic acid is obtained. Among the substances containing silicic acid, which may be used in the process according to the invention, the alkali metal silicates, such as the so-called water glasses, are most important as they melt at comparatively low temperatures. Instead of fused alkali metal silicates, the aqueous solutions of the alkali metal silicates may also be used.

When employing solutions of alkali metal silicates as the initial material in making the intermediate filaments, perfectly clear solutions freed from all impurities by filtering through a fine mesh cloth may be used, but it has been found to be particularly advantageous to precipitate colloidally a small proportion of the silicic acid by a treatment with carbonic acid or other weak acids. This colloidal silicic acid remains suspended in the solution in a finely distributed state and does not interfere with the spinning operation. If desired, the solution may be separated by centrifuging into a portion rich in silicic acid and one poor in it, the one rich in silicic acid being preferably used in making the intermediate filaments.

It has already been proposed to make filaments from alkali metal silicates, expecially from various kinds of water glass. These filaments were subsequently stabilized by means of stabilizing agents. The object of such processes was, however, the production of silicate filaments, and not of filaments consisting of pure silicic acid. Accordingly, the basic constituents not consisting of silicic acid were not dissolved and removed from the filaments first obtained in the course of the known processes.

In order to convert the intermediate filaments into filaments consisting of pure silicic acid, the intermediate filaments are subjected to a treatment with acids, salts of an acid reaction, or other chemical substances reacting chemically with the silicates. This treatment may take place in a bath of liquid, or in the gaseous phase. In the latter case, the products of the conversion of the basic components of the silicates must be removed in a separate operation. A filament consisting of alkali metal silicate may, for example, be treated with gaseous hydrochloric acid or with chlorine, and the sodium chloride may be removed by dissolving or evaporating it, thereby converting the filament into one consisting of pure silicic acid.

For the dissolving operation, water is the first choice, but other inexpensive solvents, such as diluted alcohol, may also be used. If solvents other than water are employed, they are preferably subsequently recovered.

When employing a bath of liquid for removing the basic constituents of the silicates, the so-called wet spinning process may be used, i. e. the solution of alkali metal silicate is spun directly into the acid coagulating bath. In such a case, the intermediate filament of alkali metal silicate is converted into a filament of pure silicic acid in statu nascendi. When spinning by the dry spinning process—using either fused silicates or dissolved silicates—the removal of the basic components is a separate operation performed immediately after the spinning operation.

An intermediate filament spun from fused or dissolved alkali metal silicates requires, in order to be converted into a filament of pure silicic acid, a rather drastic subsequent treatment to remove the basic components completely. In the following description, the removal of the basic components by means of dilute acids is mainly contemplated, but similar principles apply to the modifications of the invention where the dilute acids are replaced by salts having an acid reaction, or by other substances capable of reacting chemically with the basic components of the silicates.

The intensity of the acid treatment required to remove the basic constituents depends, naturally, on the gauge of the filaments. The greater the diameter of the filaments the more intense an acid treatment is required, whereas extremely fine filaments may be completely freed from basic

constituents by a comparatively mild treatment with acid.

The three factors: concentration of the acid, temperature and duration of the treatment, are so correlated, that increasing any one of them permits decrease of one or both of the others. Acid concentrations ranging between 5 and 50 per cent are preferred for removing the basic constituents from the filaments, strong mineral acids, such as hydrochloric acid, sulphuric acid, nitric acid, being particularly suitable for the acid treatment. Of the organic acids, the comparatively strong ones such as e. g. formic acid, oxalic acid, and acetic acid are suitable. Instead of aqueous solutions of acids or salts having an acid reaction, solutions also containing an organic solvent may be used, e. g. aqueous and alcoholic solutions of an acid.

Room temperature or a slightly increased temperature is sufficient, as a rule, for the acid treatment, the duration of the treatment mainly depending upon the gauge of the filaments. With filaments of a medium gauge, e. g. with a diameter of 10 to 20 microns, a treatment with nitric acid of 30 per cent for 10 minutes at room temperature is sufficient.

A modification of the removal of the basic constituents from the intermediate filaments, which is of great practical importance, consists in treating the filaments with comparatively dilute acid in the first instance and with a more concentrated solution later on; if desired, the filaments may also be washed between these steps. To use a weak diluted acid is particularly recommendable when the filaments are directly spun into an acid bath, in accordance with the wet spinning process. In that process, the employment of a more concentrated acid as the coagulating bath would result in the filaments solidifying prematurely, which makes the employment of a more dilute acid desirable, particularly in connection with the stretch-spinning process. The complete removal of the last remnants of the basic constituents is preferably obtained by a subsequent treatment with a more concentrated acid.

Both the dry spinning process and the wet spinning process may be employed in making the intermediate filaments. In accordance with the dry spinning process, the filaments are spun into air, and the conversion of the intermediate filaments into the final silicic acid filaments is brought about subsequently. In accordance with the wet spinning process, the intermediate filaments are spun into a coagulating bath, whereby they are partly converted into silicic acid filaments in statu nascendi. Both processes may be employed when using a fused silicate as well as when using a solution of silicate as the initial material.

Whether the dry spinning process or the wet spinning process is employed, silicic acid filaments are eventually obtained, which consist to a considerable extent, of colloidal or micro-crystalline silicic acid. In the case of the dry-spun filaments, the micro-crystallites are probably unoriented, and distributed at random in the filament, whereas in filaments obtained by the wet-spinning process the micro-crystallites are probably arranged in parallel to the axis of the filament, at least to a certain extent. The extent of orientation is probably increased by the stretch-spinning operation, the more so the more the filaments are stretched. This orientation of the micro-crystallites results in an improvement in the mechanical properties of the filaments, particularly in their extensibility.

The size of the crystallites can be shown to depend largely upon the conditions of formation, particularly upon the pressure and the temperature. The well-known rules regarding the hydro-thermal formation of crystals apply. Slowing down the coagulating reaction is particularly inducive to an increased extent of crystalline orientation.

In order to improve the mechanical properties of the silicic acid filaments it may be advisable to vitrify the filaments completely. This is done, in accordance with the invention, by heating the filaments subsequently to a temperature which is high enough to cause vitrification of silicic acid, or of quartz, respectively. In order to avoid the filaments being destroyed by the heat it is, however, necessary to pass the filaments through the heating zone at a high speed. Their thermal capacity being very small, they cool down, after having passed through the heating zone, so quickly that devitrification (formation of crystalline modifications of quartz such as crystoballite) need not be expected. The vitrifying temperature also depends upon whether the filaments consist of colloidal silicic acid, or of quartz (probably β-quartz), and should be chosen accordingly.

In every case, the duration of the heat treatment depends upon the gauge of the filaments. With filaments having a diameter of 5 microns, it is sufficient to draw them through a narrow, highly heated zone at a rate of 1000 metres per minute. With finer filaments, the speed may be increased still further, whereas with filaments of a larger diameter the speed at which they are drawn through the heating zone has to be reduced. During the filaments of silicic acid are drawn through the heating zone their diameter may further be reduced by a stretching process.

If the production of coloured filaments is desired, suitable mineral colouring matter may be added to the material to be spun, care being taken to use only such colouring substances which are not removed by the reagents used for treating the intermediate filaments so as to remove the basic constituents of the silicates. By way of example, colloidal metals especially colloidal precious metals, and oxidic compounds of metals or nonmetals present in a stage of oxidation other than their highest, may be mentioned as suitable colouring substances.

The invention is further illustrated in the following examples:—

Example 1

Commercial water-glass having the composition $1Na_2O$, $3SiO_2$ is fused, and the fused mass is clarified by prolonged heating or by subjecting it to a vacuum. After this, the fused mass is spun through nozzles to form filaments using a drum in accordance with the conventional method of spinning glass, or else by the injector method which is also known, and in which the filament issuing from the nozzle is caught and carried away by a jet of steam or compressed air. The required temperature is below 1000° C, which is a considerable advantage in comparison with the direct spinning of fused quartz.

Filaments coloured blue are obtained by adding to the fused water-glass some titanium dioxide reduced in a current of hydrogen, and heating until dissolution has taken place.

Example 2

Solid commercial double water-glass, having the composition $1Na_2O$, $1K_2O$, $6SiO_2$, is dissolved in an excess of water, and the solution is evaporated, preferably in vacuo so as to avoid the undesirable effect of carbon dioxide, until a concentration corresponding to a specific gravity of 60° Baumé is obtained. After de-aerating and filtering, the solution is used for dry-spinning filaments of a diameter ranging between 1 to 10 microns. The alkali is removed by a subsequent treatment, for two minutes, with a 30 per cent nitric acid. After this, the filament is drawn at a speed of 1000 metres per minute through a hydrogen and oxygen or a town gas and oxygen flame, or through an electrically heated zone.

Example 3

Commercial potassium water-glass having the composition $1K_2O$, $2SiO_2$, is dissolved in the fivefold quantity of water, and the solution is deaerated and filtered. It is then spun, by the wet spinning process, into a 5 per cent solution of hydrochloric acid serving as a coagulating bath, and wound by means of spinning centrifuges. The filament cakes are then treated first with a 10 per cent, and later with a 20 per cent, solution of acid, with or without an intermediate washing operation.

In all three examples, the stretch-spinning process is employed, i. e. the diameter of the apertures of the nozzles is ten to hundred times greater than the diameter of the final filament.

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GUSTAV WEISSENBERG.

[illegible]

[illegible]

Published June 8, 1943

Serial No. 252,298

ALIEN PROPERTY CUSTODIAN

AIR BRAKE FOR AIRCRAFT

Claude Dornier, Franz Staufer, and Hubert Währner, Friedrichshafen A. B., and Franz Bottling, Friedrichshafen-Manzell, Germany; vested in the Alien Property Custodian

Application filed January 23, 1939

The present invention relates to methods and means for artifically reducing the air resistance of aircraft.

Air brakes for reducing and controlling the speed of aircraft in flight and when landing and consisting of adjustable flaps are known. It is also known to provide one or a plurality of parachutes at the tail end of a fuselage which can be unfolded, for example, when the aircraft tends to spin.

An object of the present invention is to provide an air brake for aircraft, particularly for braking and controlling the speed of an aeroplane making a nose dive. A feature of the present invention is the provision of elements of high air resistance on the fuselage and being retractable into the fuselage of the aircraft in the rear of the tail unit. By arranging the air brake in the rear of the tail unit vibrations are prevented which otherwise occur when the brake members or elements are protracted, i. e. in operating position. If the air brake is in front of the tail unit and in operation there is such a disturbance of the air current which causes such violent vibrations of the tail unit and steering apparatus that the safety of the plane is greatly impaired. If the air brake is positioned forward of the elevator the latter and the wings are likely to vibrate. Such an ill-positioned air brake also may cause undesired trimming, a condition which is completely eliminated with the arrangement according to the present invention.

In its simplest form the brake system according to the present invention comprises at least two flaps or other elements of high air resistance which are connected to the rear part of the fuselage in the rear of the tail unit and which are operated by a suitable mechanism so as to be brought from the interior of the aeroplane into the main air current or to be removed therefrom. The brake or resistance elements may be situated in special recesses in the surface of the fuselage or they may cling closely to said surface or they may themselves form a part of the fuselage covering when in rest position. The air resistance elements may be moved into the desired position at will by a suitable actuating mechanism.

With one set only of radially extending flaps large inactive spaces are left between the individual flaps when the brake is in operating position. To eliminate or reduce these inactive spaces we provide one or more additional sets of radially extending flaps whereby the spaces left between the flaps of one set are filled by the flaps of another set of flaps.

Conventional air brakes must be moved against the air current when brought into operating position or removed therefrom and their operation requires much power. With the elements according to the present invention protruding as well as retracting is assisted by the air current. The elements according to the present invention move with the air current and not against it.

The objects of the present invention set forth so far are not sufficient to eliminate disaster. For example, the pilot may not operate the brakes in time when the speed of the plane becomes too fast. He may use the air resistance elements too late, i. e., when the speed of the plane and the air current is already so great that the impact of the air on the brake elements causes a breaking away of said elements. The present invention makes it impossible that the brake in not used at the proper moment. The projection of the brake elements is done automatically, according to the present invention, and the motion of the brake is made dependent upon the damming up of air pressure.

Having now described in a general way some of the objects and principles of the present invention, we proceed in describing some specific embodiments of the present invention. Further and other objects of this invention will be hereinafter set forth in and will be apparent from the following specification and also from the drawings which, by way of illustration show the principle and the operation of certain specific embodiments of our invention.

In the drawings:

Figure 1 is a schematic side view of an aeroplane equipped with a brake system according to the present invention.

Figure 2 is a large scale side view of the rear part of a fuselage equipped with an air brake according to the present invention.

Figure 3 is a rear view of the fuselage part shown in Fig. 2.

Figure 4 is a large scale part sectional schematic view of the rear part of a fuselage with the air brake according to the present invention in rest position.

Figure 5 is a large scale part sectional schematic view of the rear part of a fuselage with the air brake according to the present invention in braking position.

Figure 6 is a large scale part sectional schematic view of the rear part of a fuselage with the air brake according to the present invention in the first stage of the retracting operation.

Figure 7 is an isometric view of a modified air

brake proper according to the present invention.

Figure 8 is a cross sectional view of the device illustrated in Fig. 7, said view being taken along line 8—8 in Fig. 7 and in the direction of the arrows in said figure. In the upper half of Fig. 8 the air brake is shown in spread open or operating position and in the lower half in closed or rest position.

Figure 9 is a longitudinal sectional view of a modified air brake operating mechanism according to the present invention.

Figure 10 is a cross sectional view of the brake system shown in Fig. 9 and taken along line 10—10 of that figure.

Figure 11 shows the mechanism for disconnecting and dropping the brake system according to Fig. 9 from the aircraft.

Figure 12 is a wiring diagram for operating an air brake system according to the present invention.

Referring more particularly to Fig. 1 of the drawings, numeral 1 designates the aeroplane fuselage, numeral 2 a wing attached thereto, numeral 3 a propeller, 4 a tail plane, 5 an elevator, 6 are fins with rudders 7 hinged thereto. Two brake flaps 8 which are in symmetric position with respect to one another and to the fuselage are hinged at 9 to the rear end of the fuselage. To each flap an operating rod 10 is movably connected which rod extends into the interior of the fuselage and may be operated therefrom.

Figures 2 and 3 illustrate in somewhat larger scale the rear end of a fuselage which is provided with a plurality of flaps 20 which are equally distributed around the rear end and, when in operating position as shown in dotted lines 20', umbrella like surround said rear end. As can be better seen in Fig. 3, six flaps are provided the frames 24 of which are only partly covered so that air passages 25 and 26 alternate with surfaces 22 and 23 of high air resistance.

Figures 4 to 6 are more detailed illustrations of the operating mechanism for the brake flaps. Particular attention is called to the features which cause relief of the operating mechanism and reduction of power required for its actuation.

The flaps 32 are hinged to a transverse member 41 to which also the rear part 33 of the fuselage 31 is connected. The extreme rear end 33 of the fuselage is carried by an axially displacable rod 34. The transverse member 41 which carries the hinges 35 for the flaps 32 is rigidly connected with the rod 34. Rod 34 further carries the closing or retracting body 36 in the shape of a cylinder which, for the purpose of connecting it with rod 34, is provided at one end with a cone shaped part 42 the point part 43 of which is fastened to the rod 34. A bush member 37 slides on rod 34 and movably carries one end of connecting rods 38 by means of hinges 39. The other ends of the connecting rods 38 are hinged at hinges 40 to the air brake flaps 32. Hinges 40 are situated as close as possible to the extreme outer ends of the flaps 32.

Figure 4 shows the device with the flaps in rest position. In this position flaps 32 form the skin of the fuselage between parts 31 and 33. If bush 37 is moved in the direction of arrow 44, flaps 32 turn about pivots 35 until they reach the position shown in Fig. 5. The flaps or leaves 32 move in the direction of the air current which is indicated by the arrows 45; therefore very little power is needed for projecting the flaps into operating position. The movement of bush 37 may be controled during the entire length of its stroke or the movement may be just started and carried on until the ends of the flaps are slightly removed from the fuselage so that the relative wind can blow underneath the flaps and cause their full opening or swinging out. A buffer consisting, for example, of a spring 46 is provided for preventing a too violent final opening of the umbrella like air brake.

For closing the air brake and returning it into rest position bush or sleeve 37 is retained in the position it assumes in full open position of the brake and rod 34 is moved rearwards in the direction of arrow 44. This rearward movement of rod 34 requires practically no power because the rod with the brake in open condition is pulled by the relative wind. To prevent a movement too far rearward of rod 34 and parts attached thereto a stop member 47 is provided adjacent to rod 34 and fixed to the fuselage and a collar 48 on rod 34 and a spring 49 disposed adjacent to member 47 and adapted to engage collar 48 when the latter and rod 37 reach outermost position. Upon rearward movement of rod 34 closing body 36 also moves rearward and forms a continuation of fuselage 31 and closes the opening between the fuselage and the air brake. If then, or simultaneously with the rearward movement of rod 34, bush 37 is moved forward relatively to rod 34 the air brake is returned into rest position and upon forward movement of rod 34 the whole device is returned into the position shown in Fig. 4. Very little power is needed for this operating step because the cylinder 36 prevents undesirable air currents. With this method of closing the umbrella like air brake the leaves are moved in the direction of the relative wind and closing requires very little power, if any.

The brake flaps 8, 20 and 32 according to Figs. 1 to 6 leave considerable wedge-shaped inactive space when the brake is in open or operating position.

With a design of the brake as per Figs. 7 and 8 additional flaps 50 are provided which fill the otherwise inactive spaces between the flaps 32. Flaps 32 form the outer shell of the brake and, when closed, of the fuselage between the fuselage parts 31 and 33. Two adjacent transverse members 41 and 41' are provided whereby flaps 32 are hinged to member 41 and flaps 50 to member 41'.

In the device illustrated in Figs. 7 and 8, the connecting rods 38 of flaps 32 and the rods 51 of flaps 50 are not hinged to the extreme ends of the flaps but to an intermediary part of the flaps. This also reduces the power required for operating the flaps.

Figs. 9 to 11 illustrate an embodiment of our invention in which the transverse member 52 to which the flaps 53 are hinged is not rigidly connected with a rod and the rear part 33 of the fuselage but is slidable on a suitable guide member 54. The latter is rigidly connected with the fuselage and the rear part 33 thereof. Guide member 54 is preferably built up of a plurality of angle irons and has great resistance against bending and torsion. The free ends of the connecting rods 55 are not connected to a movable part but are hinged at 56 to the fuselage or the guide-frame 54. When transverse member 52 is moved forward on guide member 54 the flaps 53 are spread open. By this arrangement the number of moving parts is greatly reduced and the safety and stability of the device is increased. The construction according to Fig. 9 is also of less weight. By locating the hinges 57 of connecting rods 55 and flaps 53 substantially at the center of the flaps or rather at a point at which the air pressure acting on the flaps is balanced, the power

required to operate the flaps is much reduced. In case of too strong vibrations of the brake end of the fuselage caused by eddy air currents in the rear of the nose dive brake and/or because the brake may be damaged provisions are made to disconnect and drop the whole brake and brake operating mechanism from the aircraft.

The position of the brake in action is shown in dash and dotted lines in Fig. 9. The flap carrier 52 is then in position 52' and the flaps in position 53'.

Movement of the flap carrier 52 is caused by a motor 58 which drives a threaded spindle 59 which is rotatably supported in the frame 54. A nut 60 runs on spindle 59 and is connected by means of chains, cables or the like 61 which run over rollers 62 with the flap carrier 52. If, because of rotation of spindle 59 by means of motor 58, nut member 60 which cannot rotate is moved against the direction of flight into the position 60' the flap carrier 52 is also moved against the direction of flight into position 52' whereby the flaps 53 are spread outward or open.

Figure 10 is a cross sectional view of the framework 54 for supporting and guiding the flap carrier 52. This view particularly shows the position of spindle 59 and of ropes 61 and pulleys 62 with respect to the frame.

Figure 11 is a large scale view of the mechanism for dropping the whole air brake mechanism. Rigidly connected with the fuselage 31 are four pairs of eyes or projections 63. Between each pair fits another eye or projection 64 which is rigidly connected with the guide frame 54. Each set of projections 63, 64 is provided with an opening into which a bolt 65 is inserted which interconnects the projections and thereby the guide frame 54 and the fuselage 31. The bolts 65 are individually movably connected with the control or actuating disc 66 by means of the connecting rods 67. Disc 66 is revolvably mounted on the fuselage 31 by means of an axle 68 which carries a crank lever 69. To the free end of lever 69 a flexible member 70 such as a wire, rope, cable, chain or the like is connected and guided by means of roller 71. Upon pulling the flexible means 70 disc 66 rotates in the direction of the arrow 72 whereby the bolts 65 are removed from the eyes 63, 64. The whole brake mechanism is then free to separate itself from the aircraft and drop to the ground. The wires 73 of the electric motor 58 are plugged into a suitable plug 74 connected with the fuselage 31 and are pulled out of the plug when the air brake is dropped.

Figure 12 diagrammatically illustrates the wiring system for the motor 58 for moving the air brake into braking and into rest position. The motor receives its power from the live wires 75 and 76. By operating switch 77 the operator can make motor 58 run in the desired direction. Operation of the motor for retracting the air brake depends always on the operation of the switch 77 by the operator. Protracting the brake elements into operating, i. e., braking position is done automatically in dependence on the stemming pressure of the air; it also can be done manually. One power line between switch 77 and motor 58 is interrupted at the points 78 and 79 which are normally bridged over by the switch member 80. The latter is connected to and operated by the diaphragm 81 by means of a connecting element 82. It is held in closing position by means of the spring 83 which tends to move diaphragm 81 to the left and rests against an abutment 84 which is rigidly connected with the aircraft. Diaphragm 81 closes one side of the box 85 the interior of which is connected with the nozzle 86 which receives the relative wind and together with the pressure gauge 87 measures the stemming pressure of the air. If the latter pressure exceeds a desired and predetermined value diaphragm 81 is bent to the right and pushes, by means of the connecting rod 82, bridge member 80 over to interconnect the points 88 and 89 whereby a power circuit is closed which makes motor 58 rotate in such direction as to move the nut member 60 to the left whereby the brake elements 53 are protracted. In Fig. 12 which is a diagrammatic showing only, members 60, 61 and 54 are of somewhat different configuration than in the other figures; this is to show that the system illustrated in Fig. 12 is applicable to a great variety of brake mechanisms.

Contacts 88 and 89 together with conduits 90 and 91, if electrically interconnected by bridge 80, short-circuit the power line for operating the motor 58 in protracting direction which can be manually controlled by the switch 77. Protracting is therefore automatically caused independently from the position of switch 77. On the other hand, switch 77 can be effectively manipulated for protracting the air brake flaps independently from the position of switch member 80. As soon as the nose dive is finished and/or the relative wind pressure of a desired low value diaphragm 81 returns to the normal position in which bridge 80 interconnects contacts 78 and 79 so that the pilot may retract the brake elements into rest position by moving switch 77 to the left.

While we believe the above described embodiments of our invention to be preferred embodiments, we wish it to be understood that we do not desire to be limited to the exact details of method, design and construction shown and described for obvious modifications will occur to a person skilled in the art.

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AIR BRAKE FOR AIRCRAFT
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Serial No.
252,298
6 Sheets-Sheet 1

Fig. 1.

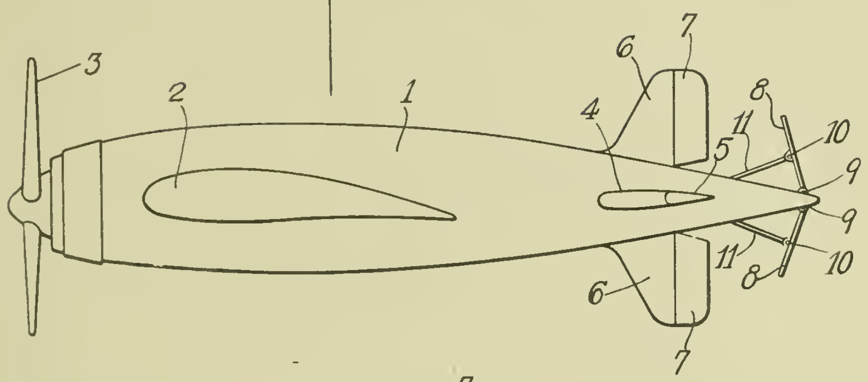

Fig. 2.

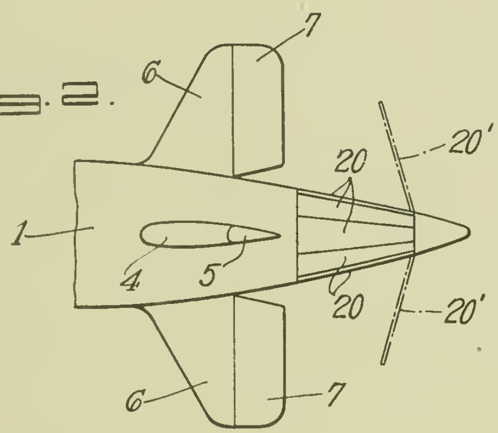

Fig. 3.

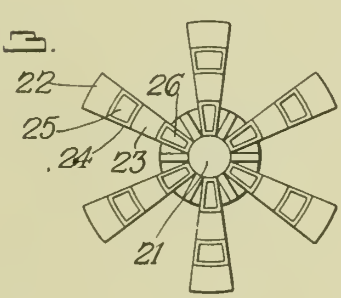

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Fig. 4.

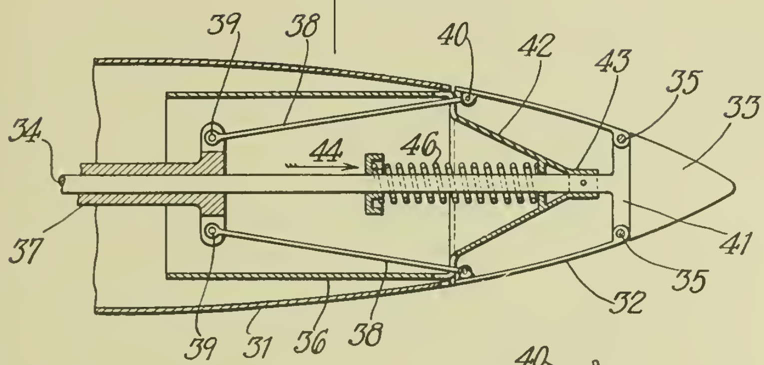

Fig. 5.

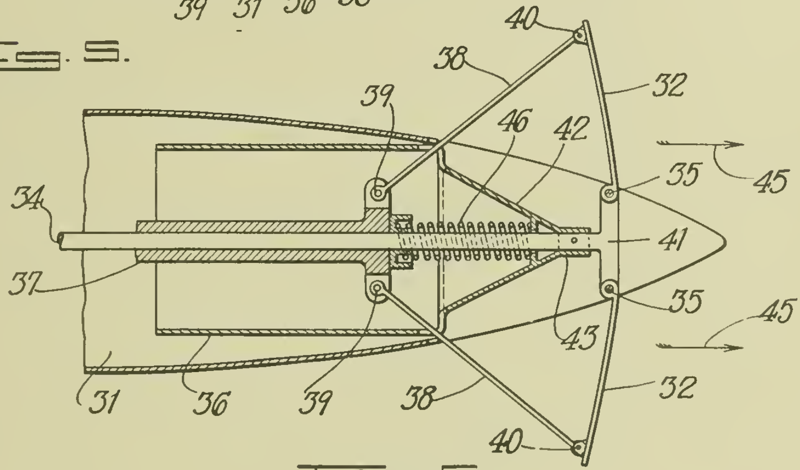

Fig. 6.

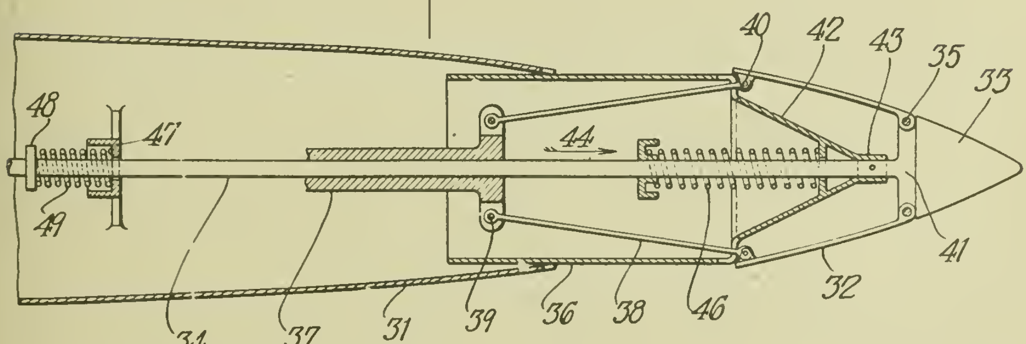

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Fig. 7.

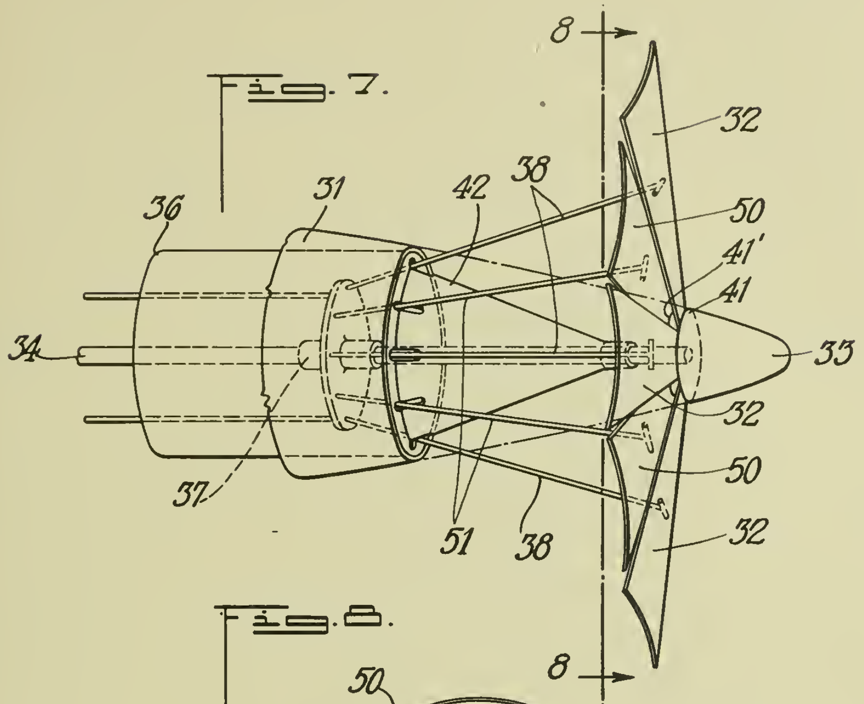

Fig. 8.

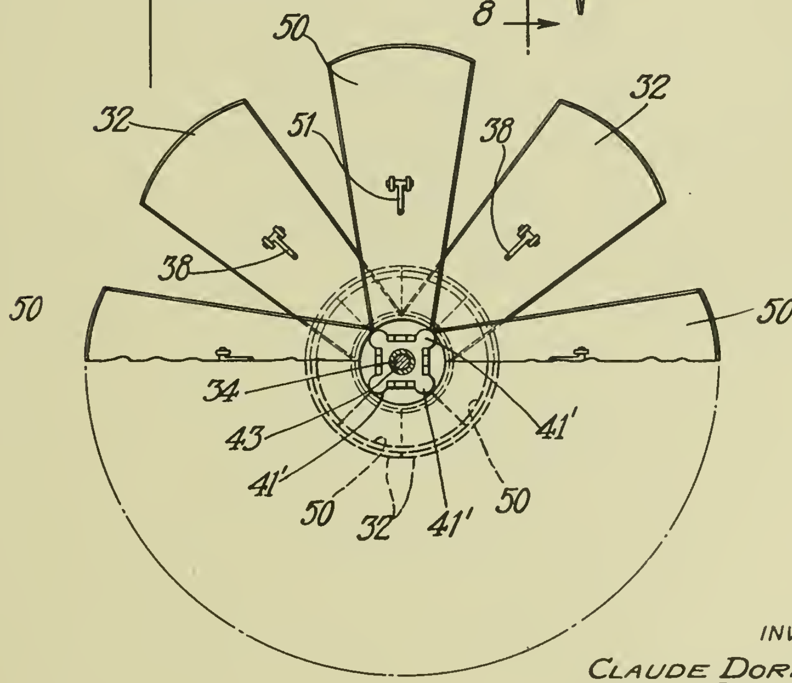

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Fig. 9

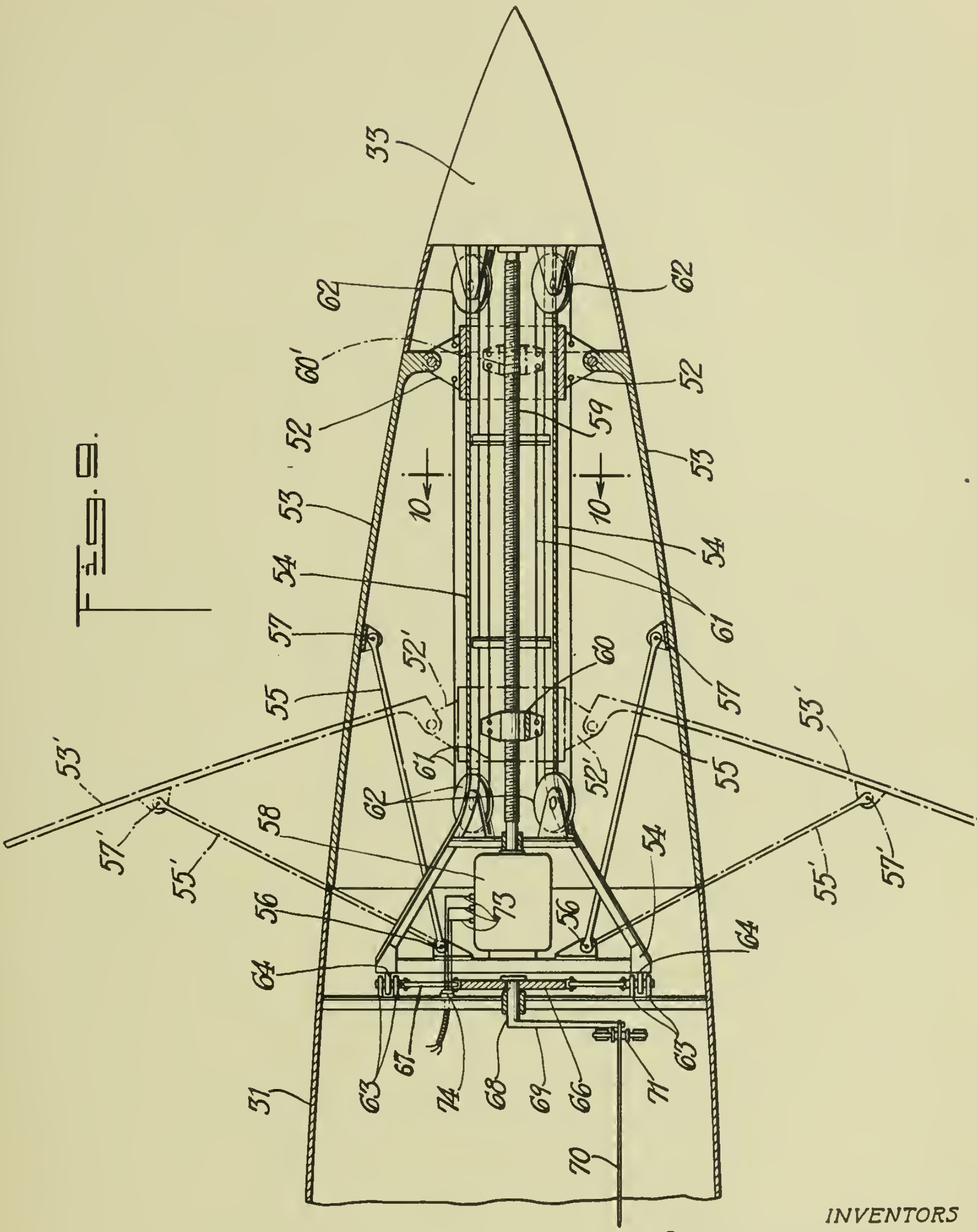

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Fig. 10.

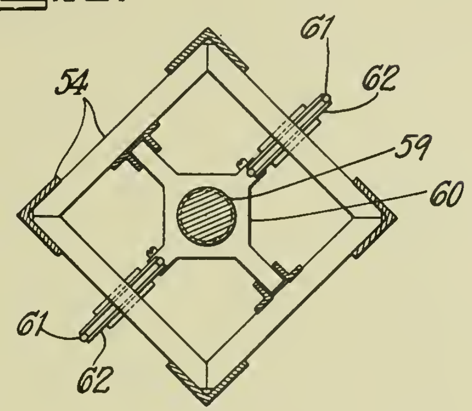
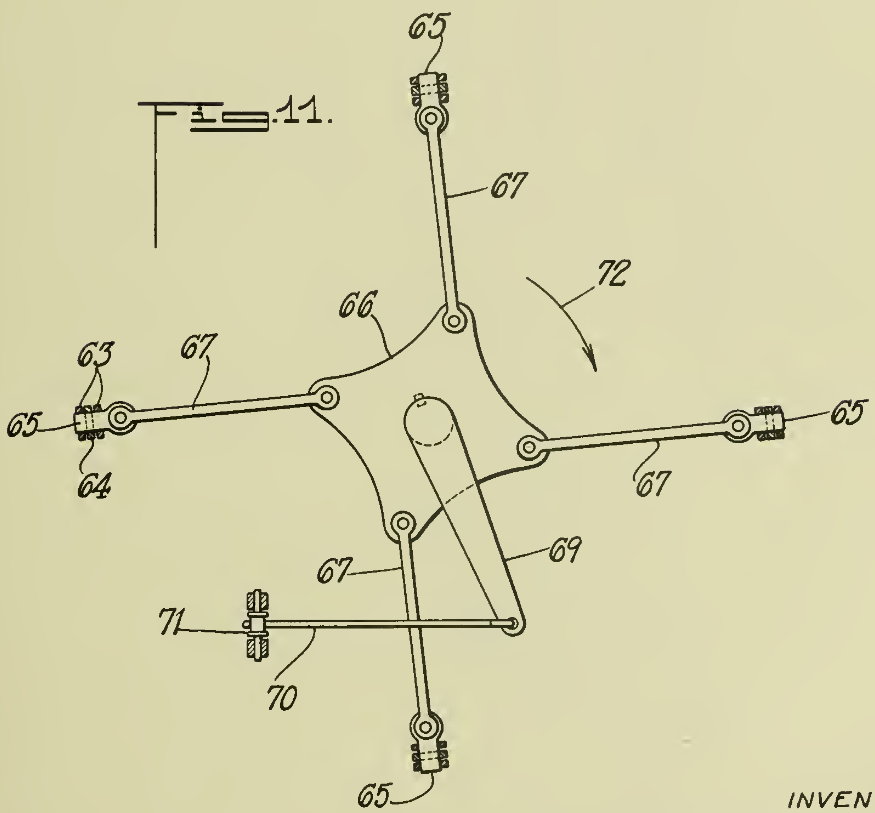


Fig. 11.



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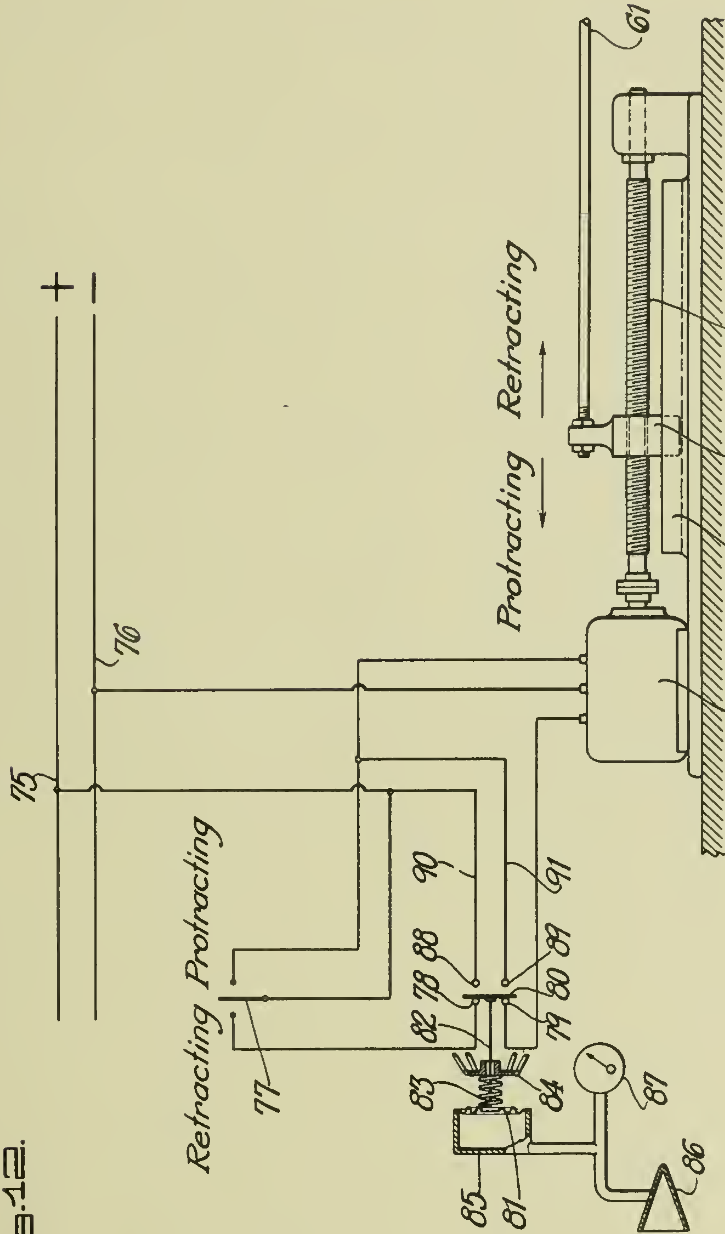

Fig. 12.

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ALIEN PROPERTY CUSTODIAN

METHOD OF PRODUCING FOOD STUFFS

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No Drawing. Application filed February 21, 1939

By comminuting different products of the soil (grains, seeds, nuts, tubers and roots) food stuffs in a general sense are produced.

The said food stuffs generally are of a one-sided composition and have their own peculiar properties, for which reason efforts are made to improve the finished product by special mixing and/or elaborating processes.

Generally speaking the treatment of the said products of the soil is directed in the first place to the most valuable and readily obtainable substances; at the same time it is tried to recover by-products.

By this separation from very complicated first materials, the drawback of one-sidedness mostly remains and the novel basic idea is to obtain in a simple manner by working together several of the said first materials those food stuffs which are most desirable considered from a technical and economical point of view.

The above mentioned products of the soil are often very different with regard to their moisture content and this may be used in practice.

The potato and the sugar beet for example are first materials of very different compositions.

An average analysis of the said products will show for the potato: about 77% of water, about 17% of starch, about 2% of albuminous substances (nitrogenous compound N x 6.25), about 1.5% of rough fibre (cellulose), about 1.3% of mineral substances, about 1% of sugar, about 0.2% of fatty substances; for the sugar beet: about 76% of water, about 17% of sugar, about 4.1% of starch substances, about 1.5% of fibre, about 1.3% of albuminous substances, about 0.1% of fatty substances.

Up to the present the potato industry has chiefly been limited to the production of starch, which used to be employed mainly for technical purposes and to a lesser extent for food stuffs. Next to the manufacture of starch potato flakes, rolled potato flour (German "Kartoffelwalzmehl"), potato baking flour and the like are produced while finally the fibrous waste was sold as a more or less inferior cattle food, mainly in a wet condition and to a lesser extent as a dry product.

As shown by the analyses, the potato contains a proportion of albuminous substances which is considerable with regard to its starch content, but up to the present it has been difficult from an economical point of view to recover the said albuminous substances and to make it profitable.

A certain similarity exists between the above mentioned treatment of potatoes and the sugar industry which in the first place has the object of producing sugar in a more or less pure form.

The sugar industry also has various waste products which are used for nutritive purposes, such as e. g. molasses, sugar pulp, dried waste pulp and wet pulp.

The nutritive value or the starch value for potato pulp and for beet pulp is low, the official figures being 0.4 for waste potato fibres and 6.5 for waste beet pulp.

The average analysis of waste potato fibre is approximately as follows: about 86% of water, about 5% of starch, about 7.7% of fibre, about 0.8% of albuminous substances, about 0.4% of mineral substances, about 0.1% of fatty substances, whereas beet pulp on the average is of the following composition: about 93% of water, about 4.7% of carbohydrates, about 0.6% of albuminous matter, about 1.4% of fibre, about 0.3% of mineral substances.

The molasses and the sugar pulp, however, are not to be considered as waste products, but more as by-products and the position is similar in the potato flour industry where the potato fibre, the starch and the albuminous substances during the working process will appear in different stages of the process with a different nutritive value.

The present invention relates to a process which makes it possible to utilize the fibrous pulp of the potato flour industry (in different stages) for efficiently producing food stuffs, both for human and for animal consumption.

The wet paste formed by the well known grinding processes of the potatoes, still contains all the constituents of the potato and accordingly has the same composition. In this mass which is semi fluid on account of its high water content the starch and the fibrous material are present in undissolved condition, whereas the albuminous matter, sugar, mineral substances and fatty substances are in dissolved condition. As soon as the said liquid constituents have been more or less removed in some manner, e. g by centrifuging or by pressing, sieving, washing, etc., or by a combination of these processes, the fibrous mass obtained thereby will immediately be able to absorb other wet materials.

The primary wet paste will contain free starch, i. e. starch adapted to be washed out, and also starch surrounded by fibres, i. e. bound starch, the proportion of which varies in accordance with the opening of the cells which consist of fibrous material.

It is of course, also possible to separate during the said process the starch capable of being washed out. The capillary action of the fibre

cells in the fibrous pulp even causes liquids to be absorbed from wet materials, whereby the said materials may easily be subjected to further desired treatments. The fibrous cells from which the substances present have been extracted to a greater or lesser degree will therefore act as moisture absorbing agents and furthermore as carriers for other masses diffcult to handle which will be mentioned hereinafter so that novel and absolutely homogeneous food stuffs are formed, and at the same time the production thereof is very much simplified and a great deal of expense is saved.

According to the invention the cellulose material is made to absorb other comminuted substances such as e. g. ground sugar beets, beets which are generally used as a cattle food (German "Frutterrüben") and other products of the soil, even comminuted green fodders. The purpose now is to grind simultaneously with the above mentioned industrial treatment of potatoes, other products e. g. sugar beets, by means of the same apparatus and to conduct the beet pulp thus formed to the carrier prepared for that purpose. This has the advantage that there is no need of losing any constituents out of the ground beets. If desired, it is possible to control the proportion and the quality of the carrier and of the material to be combined therewith in such a way that the former is adapted not only to absorb the entire beet mass as described above, but also other substances valuable as food materials, e. g. the albumen of the potato.

The concentration of the albuminous substances from the potato juice as is well known, is rather easy. Preserving and drying, however, present serious difficulties. According to the method claimed, however, there will not be any trouble, not even if considerable percentages of substances are to be absorbed. After the constituents of the novel food product to be produced have been brought into intimate contact with each other, whereby a new homogeneous matterial is obtained, the said material is dried at once by means of a suitable drying device. The said homogeneous substance thus produced constitutes a porous mass adapted to be divided in any particular condition for the drying process suited therefor. Another property of the said mass is that it will easily lose water during drying.

The drying process may be carried out either by means of open, direct heating, or in rapidly circulating air at a high temperature, or in a vacuum drier, or on a cylinder. The choice of the drier will naturally influence the properties of the finished food material. Care should be taken to remain within the limits of the moisture norms required by the technics of drying. The drying process may purposely be carried out in such a way that the products obtained will have special characteristics, e. g. by chemically modifying the starch, by binding the albumens or by converting sugar into invert sugar.

With regard to what has been stated above concerning green fodder it is still to be observed that it is possible to use the whole beets i. e. together with their tops and leaves, after having cleaned them thoroughly. The beet leaves per se may thus be utilized.

An analysis of a beet leaf will show valuable components viz.: about 84% of water, about 7.4% of starch substance, about 4.3% of mineral substances, about 2.3% of albuminous matter, about 1.6% of cellulosic material, about 0.4% of fatty substances.

This latter possibility is of great economic significance, because although the beet top and the leaf are used as cattle food, they are only of slight value until now and there is a considerable loss. Moreover by using the beets in the above manner a great deal of labour is saved in the gathering of the beets.

The novel food products may be manufactured in any desired form, e. g. in the shape of flour, granules, lumps or briquettes. This latter form has the advantage that because of the characteristic properties of the product there will be no need of binding agents.

The food products thus obtained are of a very pure and pleasant taste.

When used as a cattle food, the product is liked by the animals while both the nutritive value and the digestibility of the product can be perfectly controlled.

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ALIEN PROPERTY CUSTODIAN

METHOD OF OBTAINING ALUMINIUM FROM CLAY

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No Drawing. Application filed February 25, 1939

The hitherto known method of obtaining aluminium according to the method of Héroult-Hall of 1887 requires the use of the special aluminium ores (bauxit) and admixtures to them (kriolith), present only in a few countries.

Furthermore this method as the one based on obtaining metal from oxide requires the consumption of great amount of energy, because the heat of formation of Al_2O_3 amounts to 380 Cal per 1 grammolecule of this compound.

The method of obtaining aluminium from aluminium chloride as described hereafter does not require the import from abroad either of the aluminium ore or the additions for them and requires the lesser consumption of energy, because it is based on the electrolysis of the aluminium chloride ($AlCl_3$), the formation heat of which amounts to 162 Cal per 1 grammolecule of $AlCl_3$.

The clay is roasted with coke and is submitted to the action of chlorine. The distillate or the sublimate contains aluminium chloride and other chlorides, volatile in these conditions. The separation of the aluminium chloride is done by means of fractional distillation or fractional sublimation. The sublimated pure aluminium chloride is melted under the minimum pressure of 2,5 atmospheres of the dry chlorine at the temperature of at least 190° C and is decomposed by the electric current—without the addition of potassium chloride or sodium chloride. The carbon electrodes are employed here. The cathode from the beginning of electrolysis is covered by a thin aluminium sheet and is movable. The pressure of the chlorine in the electrolyser is regulated automatically, whereas the level of the electrolyte is maintained constant.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR TREATING BITUMINOUS SUBSTANCES

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Application filed April 3, 1939

This invention relates to bituminous substances and is more particularly concerned with an improved method of treating bituminous substances with a dehydrogenating gas, such as chlorine.

It is a purpose of this invention to produce a bituminous substance with exceptionally low temperature susceptibility. Another object of the invention is to decrease the temperature susceptibility of bituminous substances without materially affecting the Fraass breaking point. It is still another object to improve the uniformity of the reaction between the bituminous substance treated and the dehydrogenating gas so that a more uniform product results. It is a further purpose to produce from bitumen a useful product having rubber-like properties.

It is known that blowing bitumen, such as a petroleum residuum, with air, steam, etc., has the effect of lowering the susceptibility to temperature. However, many blown asphalts and especially those that have been blown sufficiently to materially decrease their temperature susceptibility are known in general to be relatively brittle. It is further known that the addition of a small amount of a halogen in the gaseous state to the air being blown through bituminous substances may have the effect of producing a bituminous substance possessing lower temperature susceptibility and being less brittle than a bitumen treated with air alone. However, in the known methods of treating with a halogen such as suggested in U. S. Patents 2,059,051, and 1,979,677 disclosing blowing chlorine and air through a perforated pipe placed in the base of a cylindrical still containing the bituminous material to be treated, only relatively small amounts of chlorine may be used to advantage. Under the conditions of these patented processes, the dehydrogenating gas, e. g., chlorine, seems to pass through the viscous bitumen in the same channels for relatively long periods thereby causing local over-reaction and formation of carbenes without forming sufficient amounts of resins and asphaltenes necessary in asphalt compositions which are properly balanced, so that they will not separate on standing. To prevent this local over-reaction of the bitumen, comparatively small amounts only of chlorine have been allowed to react in the known processes. Although such treatments may give products superior to air blown asphalts, they are incapable of improving the temperature susceptibility and other properties of asphalts to an extent possible by the method of our invention without causing harm to other properties.

In accordance with our invention we pass a dehydrogenating gas e. g. chlorine, through the space above the surface of the bitumen, preferably at an elevated temperature while mechanically agitating said bitumen. By this method of treating the dehydrogenating gas continuously comes in contact with newly exposed surfaces, and a surface once formed stays in contact for a very short period only. In this manner over-reaction is positively reduced to a minimum. The bituminous products of our method are quite homogenous and do not separate on standing even when quantities of chlorine or other dehydrogenating gas have been used, sufficient to produce an infusible bitumen.

In carrying out our invention we may employ any gas having dehydrogenating powers greater than air such as chlorine, bromine, iodine, sulfur dioxide and the like. The dehydrogenating gas may be diluted with an inert gas or one having lower dehydrogenating power such as air, carbon dioxide, nitrogen, etc., for the purpose of controlling the reaction and for preventing its becoming too violent. The degree of dilution may vary with the temperature of treatment, substance treated, and the nature of the desired product and may be ascertained by preliminary tests. The dehydrogenating gas may be used in amounts ranging from 10 to 30% by weight of the bitumen treated, and should be introduced into the reaction space slowly over a relatively long period of time, e. g. of about ½ to 5 hours. The exact amount of such gas employed depends upon the characteristics desired of the product. Although the process is especially advantageous when treating with large amounts of a dehydrogenating gas to produce bitumen of exceptionally low temperature susceptibility without causing harm to certain other properties, the uniformity of the reaction and resulting product will make it equally useful when treating with relatively small quantities of said gases, i. e., less than 10% by weight of the bitumen.

About 10% of the dehydrogenating gas may combine with the bitumen, the remainder being converted to HCl, HBr, H_2S, etc., as the case may be. Some of the gaseous reaction products may be retained by the treated bitumen and may if desired be removed by maintaining said treated bitumen at a temperature of about 200° C. while stirring and passing an inert gas such as carbon dioxide, nitrogen, or the like, through the bitumen.

The mechanical agitation of our process is accomplished by stirring with stirrers, paddles, circulating pumps, or by kneading or means other than bubbling the reacting gas or gases through the bitumen being treated.

The bitumen subjected to our treatment may be a topped mineral oil, natural asphalt, still residuum asphalt, naphthenic extract from lubricating stock, or other bituminous substance. We prefer to carry our treatment in the absence of solvents for bitumens such as carbon tetrachloride, carbon disulfide, benzene, pyridine, etc.,

because of the danger of forming undesirable substitution products including highly chlorinated or otherwise reacted products of the solvent itself.

The temperature of the reaction is advantageously between about 175° C. and 275° C. and preferably between 200° to 230° C. At relatively low temperatures the reaction may proceed too slowly and incompletely, and if temperatures become too high the bitumen may decompose.

The reactions which take place in the presence of the dehydrogenating gas are believed to be primarily dehydrogenation and condensation reactions analogous to the Friedal and Crafts' reaction and to a very minor extent only reactions involving additions or substitutions of the dehydrogenating gas. The final product may be semiliquid, plastic or resembling rubber, depending upon the amount of dehydrogenating gas used in the reaction. The formation of non-fusible, elastic, rubber-like products, which occurs when using relatively large amounts of dehydrogenating gas is evidence that a simultaneous polymerization and condensation may take place.

The products prepared according to our process may, because of their exceptionally low temperature susceptibilities be used especially for insulating purposes in places calling for severe requirements due to large variations in temperature. The similarity of infusible reaction products to crude rubber make their use as a partial or complete substitute for rubber appear possible in many cases. Typical rubber-like products usually contain less than 3½% chlorine and usually between 1½ and 3% chlorine. Such products may and usually do have Fraass breaking points of —25° C. or below if produced from bitumens originally having breaking points that low or lower.

The invention may be more fully understood by referring to the drawing which represents an apparatus suitable for our treatment.

The bitumen to be treated is introduced, if desired after preheating, through line **1** into the cylindrical still **2**, until the desired level **7** is reached. The bitumen is maintained at an elevated temperature, preferably at about 220° C. by passing super-heated steam or some other heating medium through the heating jacket **3**. When the desired temperature has been reached the bitumen is treated with a suitable amount, e. g. about 10 to 30% of chlorine. The chlorine is metered into line **4** and may be diluted with air from line **5**. The resulting gaseous mixture is then slowly passed through line **6** into the space above the surface of the bitumen. The bitumen while being treated with said gaseous mixture is constantly agitated by means of stirrers **8**. When the introduction of the chlorine is substantially completed an inert gas may be blown through the perforated pipe **9** to remove any volatile reaction products, such as HCl, which are vented through line **10**. The reacted bituminous product if in a flowable condition may be withdrawn through bottom line **11**, or if incapable of flowing, through detachable still head **12**.

The following examples further illustrate our invention.

The softening points as reported in these examples were determined by the A. S. T. M. ring and ball method. All penetration measurements were made at 25° C. according to the A. S. T. M. method with a 100 gram load. The breaking points were determined by the Fraass D. I. M. method (German Bureau of Standards), and dropping points by the Ubbelohde method. The temperature difference between the breaking point and softening point of the bitumen is a measure of its useful temperature range, the breaking point giving the temperature of excessive brittleness and the softening point being a measure of the melting temperature.

Example I

100 kg. of petroleum bitumen of 27° C. softening point, having a penetration above 800 and a Fraass breaking point of below —25° C. was treated at 220° C. with a bromine vapor-air mixture, while vigorously stirring. 13.71 kg. of bromine were introduced over a period of 110 minutes. The bromine content of the reaction product amounted to 1.75%, 11.96 kg. of bromine having been converted to HBr. The penetration of the treated bitumen amounted to 30. Its softening point was now 118° C., the dropping point 130° C.; the Fraass breaking point remained below —26° C. which means the bitumen that once softened at 27° C. now had a useful range between —26° C. and 118° C. without being brittle or soft.

Example II

100 kg. of petroleum bitumen of 27° C. softening point, penetration about 800 and Fraass breaking point of below —25° C. was treated at 220° C. with a chlorine-air mixture while vigorously stirring. 16.76 kg. of chlorine were introduced over a period of 120 minutes. The chlorine content of the reaction product amounted to 1.72%, 15.04 kg. of chlorine having been converted to HCl. The penetration amounted to 16; the softening point of the bitumen was now 160° C.; the dropping point about 180° C., and the breaking point, Fraass method, was still —25° C. which meant the product could be used up to 160° C. without softening, and down to —25° C. without becoming excessively brittle.

Example III

100 kg. of topped asphaltic crude oil having a viscosity of 10.2° Engler at 100° C. was treated at about 220° C. with a chlorine-air mixture, while vigorously stirring. 24.80 kg. of chlorine were introduced over a period of 170 minutes. The chlorine content of the reaction product amounted to 1.96%, 22.84 kg. of chlorine having been converted to HCl. The bituminous product obtained was rubbery and could no longer be evaluated by the usual testing methods for bitumens. It was no longer fusible and had to be kneaded into the testing devices. The softening point was higher than 165° C., the Fraass breaking point was lower than —27° C.

Example IV

100 kg. of a topped sulfur dioxide extract of a heavy machine oil, having a viscosity of about 3° Engler at 100° C. was treated at about 220° C. with a chlorine-air mixture, with vigorous agitation. Chlorination was continued until the chlorine content of the bituminous product of the reaction amounted to about 3%. The product obtained was no longer fusible; the softening point as well as the dropping point could not be determined. The once fluid extract had become plastic. The Fraass breaking point was lower than —27° C.; the apparent penetration at 25° C. was about 41.

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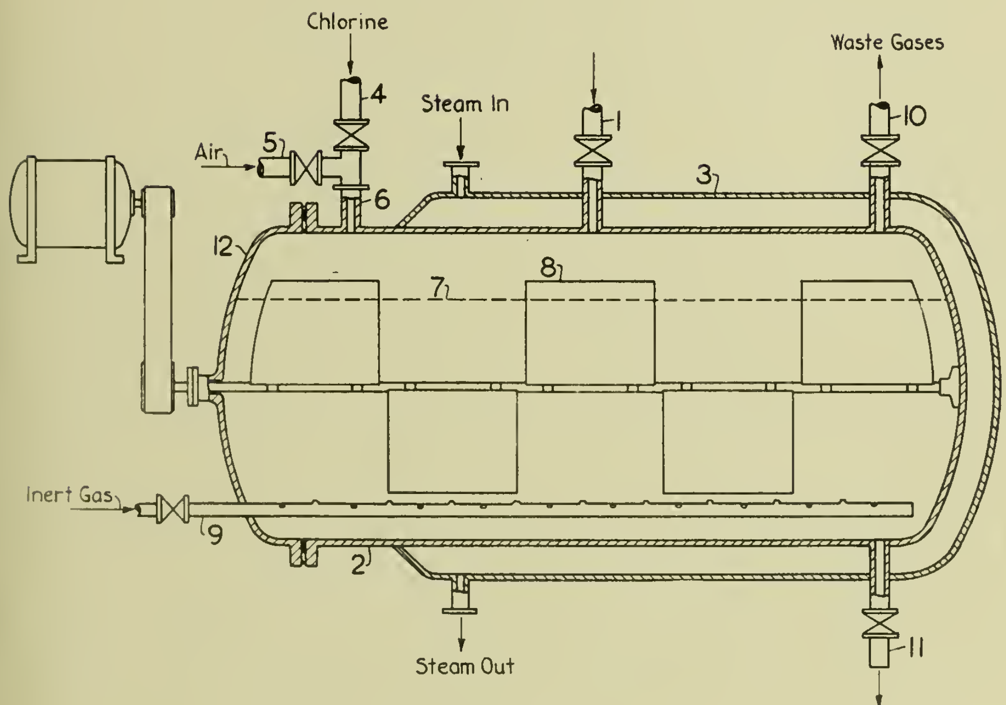

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Othmar Pauer

By their Attorney: ____________

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ALIEN PROPERTY CUSTODIAN

CENTRIFUGAL PUMPS OR THE LIKE

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This invention relates to centrifugal pumps, fans, blowers, compressors and the like for liquids or gases and is concerned with the design of the impeller that forms part of such apparatus.

According to this invention the impeller has ducts which, throughout a part near the outlets, have an axial component of direction, are non-divergent and are backwardly curved (i. e. backwards relative to the direction of rotation).

By "non-divergent" is meant that throughout the part that is so characterised any normal cross section thereof, if superimposed upon any normal cross section thereof which is more remote than itself from the outlet, will not overlap the same either at all or to any substantial extent. Such a construction gives increased efficiency and it is believed that the reason is that eddying and turbulence are thereby diminished.

The degree to which such overlap can be permitted will depend upon the size and capacity of the apparatus and the nature of the fluid to be conveyed, but it must not be so great as to cause material loss of efficiency as compared with a construction wherein there is no such overlap.

Backwards curvature provides a satisfactory method of making the ducts non-divergent throughout a part which has an axial component of direction.

Preferably the ducts are made non-divergent also in a part having a radial component of direction and preceding, i. e. more remote from the outlet than the above-mentioned part. The greater the length of the non-divergent parts the higher will be the efficiency and to obtain the theoretically best result the ducts should be made non-divergent throughout their length.

Preferably the cross sectional area of the non-divergent part or parts of the ducts is progressively reduced towards the outlet. In the case of a tetragonal duct the cross sectional area may be made to decrease by causing both pairs of opposite walls to converge or by causing one pair only to converge. If the fluid to be conveyed has a high viscosity, e. g. as in the case of common engine lubricating oil, if one pair of opposite walls has a convergence of 5°, while the other pair remains parallel, an advantage is obtained. The degree of convergence must not be so great that the ducts become unduly constricted, thereby causing loss of efficiency.

The inlet and outlet of each duct are preferably substantially tetragonal but from the inlet towards the middle portion of the duct the corners are preferably progressively rounded and the duct is preferably made again progressively to approach the tetragonal form towards its outlet.

The ducts can be made non-divergent in a part preceding the backwardly curved part by progressively thickening the vanes of the impeller (i. e. the parts forming the walls separating a duct from the adjoining ducts) in the direction towards the outlet. The vanes can be made integral with the body of the impeller but it is convenient to make them separately and to assemble them upon such body. Preferably the cross sectional area of the duct is simultaneously progressively reduced and preferably this is accomplished by causing the remaining walls of the duct to converge.

It is preferred to form the outlet of each duct in such a manner that the stream issuing from a duct becomes merged gradually with those issuing from the adjoining ducts without objectionable eddying or turbulence. In order to achieve this the thickness of the vanes must be progressively decreased towards the outlet. This can be accomplished, while maintaining non-divergence, by curving the vanes (and therefore the ducts) backwardly to a sufficient extent. Preferably this backwards curvature takes place only in the part of a duct which is near the outlet and has an axial component of direction and preferably in that part the backwards curvature is sufficient to cause the walls constituted by the vanes to converge. Preferably the vanes are radially disposed elsewhere.

The accompanying drawings show a typical embodiment of the invention.

Figure 1 is a section of the impeller.

Figures 2, 3, 4 and 5 are cross sections of a duct on the lines A—A, B—B, C—C and D—D respectively of Figure 1.

Figure 6 shows the cross sectional areas of the duct sections of Figures 2, 3, 4 and 5 superimposed.

Figure 7 is a development of a vane on the line X—Y of Figure 1.

Figure 8 is a development of one duct on the line X—Y of Figure 1.

Figures 9, 10, 11, 12, 13 show the cross sectional area of the duct on the lines *d—d*, *c—c*, *b—b*, *a—a* and *e—e* of Figure 8 which correspond to the lines D—D, C—C, B—B, A—A and the outlet, respectively, of Figure 1.

Figure 14 shows the cross sectional area of the duct sections of Figures 9, 10, 11, 12 and 13 superimposed.

In Figure 1, 1 is the impeller with which this

invention is concerned. 2 is the shaft on which the impeller is mounted. When the impeller 1 is rotated by any prime mover, liquid flows therein by centrifugal action from the inlet 4 thereof to the outlet 5 thereof whence it is discharged.

The front and back walls of the ducts in the impeller are formed by the members 9 and 10 and the side walls are formed by the vanes 11, 12. 7 and 8 are rivets securing these vanes to the members 9, 10.

At the inlet (Figure 5) the vanes are thin and the cross sectional area of the ducts of the impeller is at a maximum.

The thickness of the vanes is thereafter progressively increased as shown in Figures 4, 3 and 2 so as to maintain the walls of the ducts formed by the vanes 11 and 12 non-divergent, notwithstanding that the vanes are extending radially outwards from the axis of rotation. The walls 9 and 10 are progressively brought closer together to reduce the cross sectional area, the height of the vanes being accordingly reduced. Figure 6 shows the successive cross sections of the duct superimposed and it will be seen that the side walls remain the same distance apart while the top and bottom walls are converging. The vanes have been thickened as shown in Figure 7 from the point 13 at the inlet to the point 14 corresponding to the line A—A of Figure 1. Throughout this part the duct has a radial component of direction.

Thereafter from the point 14, the vane is turned backwards towards the outlet so that the thickness of the vane may be progressively reduced while the duct remains non-divergent as shown in Figure 8. Throughout this part the duct has an axial component of direction. In the embodiment illustrated, in the latter part of each duct i. e. from the line *a—a* (Figure 8) to the outlet, the sides of the duct constituted by the vanes converge (the backwards turn being sufficient for this purpose) and the walls of the duct formed by the members 9 and 10 are maintained parallel.

The vanes are progressively rounded as shown at 15 (Figure 4), 16 (Figure 3), and 17 (Figure 2) in order that the duct which is tetragonal at the inlet and the outlet may not have sharp corners throughout the greater part of its length. This accounts for the D-shaped cross-section of the outlet shown in Figure 13 on the line *e—e* of Figure 8. One side of the outlet is constituted by a part of a vane which is some distance from the tip and is still somewhat rounded, while the other side is constituted by the tip of a vane which has there ceased to be rounded.

The radius of curvature of the part 9 should not be more than about twice the radius of curvature of the part 10.

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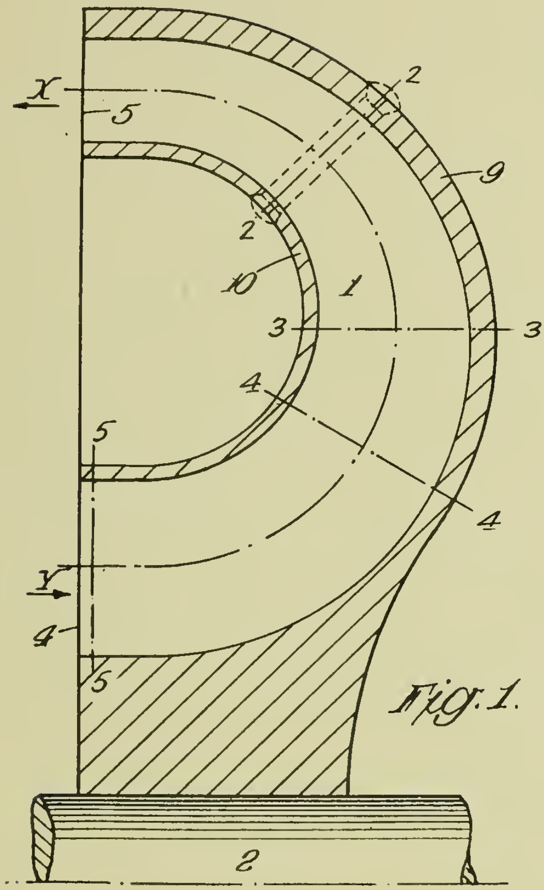

Fig. 1.

Fig. 4

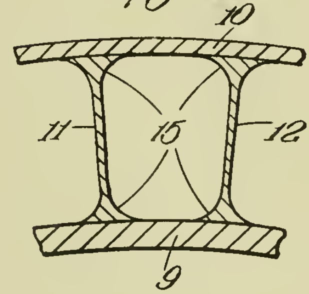

Fig. 5.

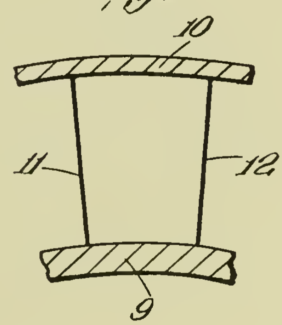

Fig. 2.

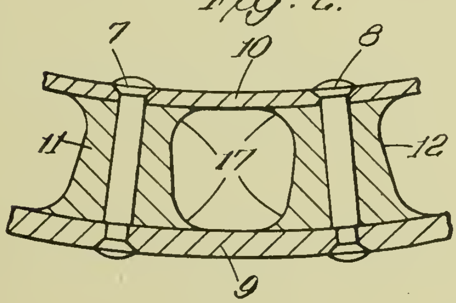

Fig. 3.

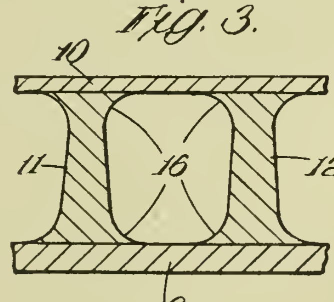

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Fig. 6.

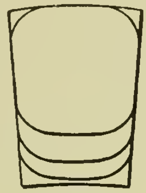


Fig. 7.

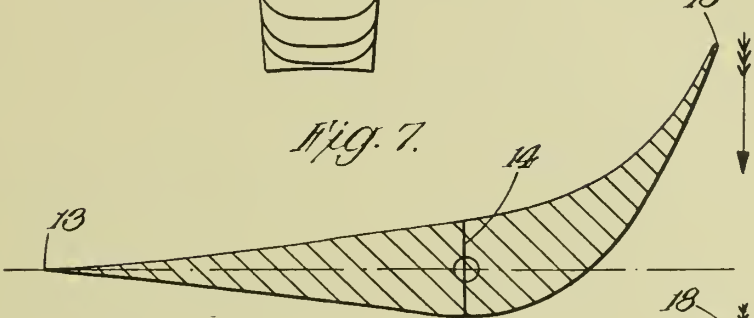


Fig. 8.

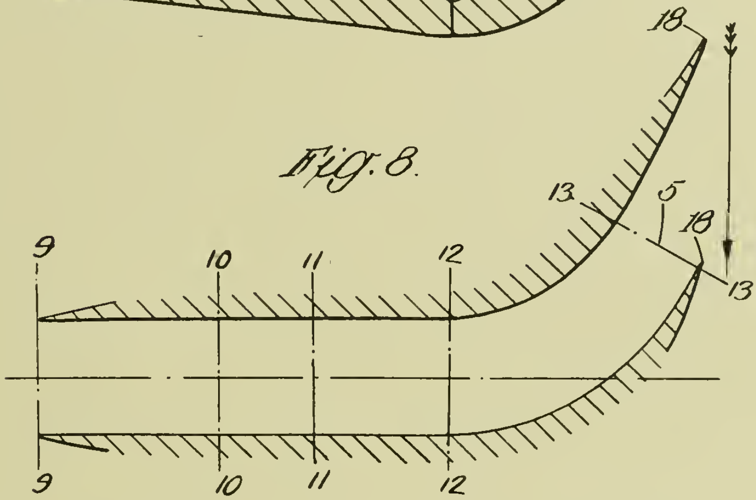


Fig. 9.

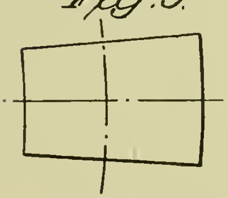


Fig. 10.

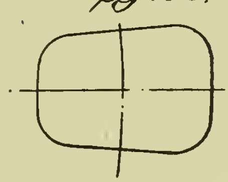


Fig. 11.

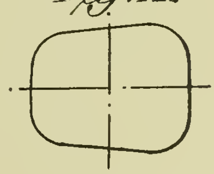


Fig. 12.

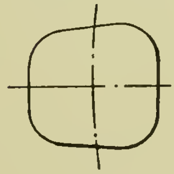


Fig. 13.

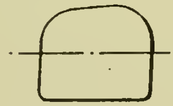
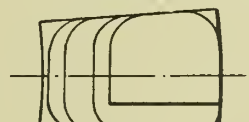


Fig. 14.



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PROCESS FOR PRODUCING A PROTECTING LAYER AGAINST CORROSION ON THE SURFACE OF METALS OR ALLOYS

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No Drawing. Application filed April 19, 1939

This invention relates to a process for producing a protecting layer against corrosion on the surface of metals or alloys, this layer being adhesive, strong and subsequently liable to undergo a strengthening, a dyeing or painting.

According to this process, the metal or alloy are treated with a solution containing such ions as to yield at least one readily hydrolysable salt at the expense of the metal or alloy. This salt is subsequently hydrolised to leave a protecting layer on the metal or alloy, this protecting layer being made up of an oxidized compound such as a hydroxide, an oxide or a basic sub-salt.

This invention enables to treat even quite extended surfaces very economically. It makes use of baths made up of ordinary water and of smallest amounts of unexpensive salts. The machinery is very simple and may entirely be made up of steel. The obtained coatings, without being as thick and strong as those obtained by electrolysis, are, however, quite sufficient for most practical wants, and they constitute an excellent protection against corrosion, above all after having undergone an impregnation.

According to this invention no foreign compound to the metal is deposited on the latter; the metal is not directly, but indirectly oxidized.

The treatment may take place in a single bath or also in several successive baths; it is possible to vary the composition of the baths during the treatment, and the same may also be done with any other working condition.

It is also permissible to add to the aforementioned solution a certain amount of the hydrolysable salt which is to be formed at the expense of the supporting metal or alloys.

For producing a hydrolysable metallic salt, the metal is treated with an acid or with a salt and by preference with a weak acid or with a salt deriving from a weak acid. In order that the hydrolysis of the obtained metallic salt may really take place and form a protecting oxide coating on the metal, the operation is effected in such conditions as known to promote hydrolysis; this means that the dilution and the temperature are increased. In order to obtain a very diluted solution of the hydrolysable salt, the treatment is therefore effected with a diluted solution of the reagent. The reagent will then exert but a slight action upon the metal, and this action will cease as soon as the protecting layer will be formed. Briefly, the metal is treated with a hot and diluted solution of an acid or a salt, by preference with a hot and diluted solution of a weak acid or of a salt deriving from a weak acid, the reagents being chosen in such a manner as to give a salt of the metal by direct attack (when a weak acid is used) or by displacing of a base (when a salt of a weak acid is used), which is hydrolysable.

In the case, for instance, of aluminium, magnesium and their alloys, the treatment may be effected with a solution of alkaline or earthy-alkaline cyanides or sulfides, or with any other salt deriving from a weak acid. The hydrolysis takes place as soon as the salt of the light metal is formed, and the supporting metal receives then an adhesive layer made up of an oxide, hydroxide or of a basic sub-salt.

It must be noted that the action of these reagents was hitherto considered as continuing indefinitely without producing the aforementioned effect, and it was admitted that the metal would indefinitely be dissolved. This invention just states the new fact that if the dilution of the reagents is very great in order that the hydrolysis phenomena may take place, and if the treatment is effected in such conditions as to promote the hydrolysis as far as possible, a rapid slackening and then a stopping of the ordinary dissolution of the metal occur, and the hydrolysis process produces then an oxidized protecting layer on the supporting metal.

The particular regulating of the reaction giving good results is illustrated, but not limited, by the following example:

The metal is treated with a very diluted solution (of about 1 gr. per litre) of alkaline cyanide. The operation takes place at 80–90° C. in a reflux-apparatus. The metal is first strongly attacked by reason of the hydrolysis of the alkaline cyanide itself; the formation of a cyanide of the treated light metal takes place, but this cyanide is strongly hydrolised and instable in the conditions of the experiment and gives, at once, rise to the formation on the supporting metal of a hydroxide layer of the same metal. When aluminium is treated, there is, moreover, formation of an alkaline aluminate which partly dissolves in the bath to a limited concentration and undergoes, in its turn, a hydrolysis yielding thus a supplementary amount of hydroxide to the coating. Practice has shown that this second stage does not give rise to a good coating, and care must be taken to limit it. The volume of the bath must be sufficient in order that the aluminate concentration has no time to become troublesome before the formation of the protecting layer.

The formation of the protecting layer progressively slackens the attack of the metal; it is nearly stopped after one hour of working. After rinsing for eliminating the useless or prejudicial products, the metal is coated with a thin, adhesive, resisting and smooth layer. When the volume of the bath is insufficient and the precipitation of aluminate takes place, the layer is dusty and brittle.

The composition of the baths to be used for the treatment is illustrated, but not limited, by the following examples:

Pure aluminium

Temperature: 75–85° C; duration of the treatment: 1 to 3 hours.

Per litre of ordinary water:

		Gr.
(1)	Alkaline cyanide	2 to 4
	Alkaline chlorate or perchlorate or acetate or oxalate or sulfite or fluoride or sulphide	3
(2)	Alkaline cyanide	3
	Alkaline fluoride	1
	Alkaline sulphide	1

Duraluminium and cast alloys

Temperature: 75–85° C; duration of the treatment: 1 to 3 hours.

		Gr.
(1)	Alkaline cyanide	4 to 6
	Alkaline acetate or perchlorate or chlorate or oxalate or sulfite	4 to 6
(2)	Alkaline cyanide	4 to 6
	Alkaline chlorate or oxalate or sulfite	6 to 18

Eventually, an alkaline sulfate (up to 30 gr. per litre) may be added for discolouring the layers, if they are liable to become coloured.

It may be also be made use of the continuous electric current without greatly modifying the process, the treated metal being at the anode. In the aforementioned example, the electric current promotes the formation of the cyanide of the treated metal and its intensity shall remain very low, because a too intense formation of this cyanide opposes to its immediate hydrolysis, and the hydroxide layer is made up of nonadhesive sheets coming easily off and constantly formed anew. It may also be made use of the alternative current and its effect seems to be favourable.

It may also be made use of chemical agents to modify the hydrolysis conditions of the dissolved salts, and the process does not then undergo any deep change. The baths may be stirred, and use may be made of vessels having shapes of any kind, diaphragms and so on. In a general manner, it is advisable to eliminate by mechanical way or by any other means, the bubbles which will remain adhesive to the metal and which are mainly produced at the beginning of the treatment; these bubbles would produce unprotected spots.

Moreover, care must be taken to avoid any defect such as straws, holes, and above all, inclusions of foreign bodies and more particularly those of metals, on the surface to be treated. Thus, it happens frequently that small iron particles, coming from roller-cylinders and more particularly from heated rollers, become incrusted in aluminium surfaces and form non-protected spots.

The bath may also be modified in order to adjust the hydrolysis reaction or to modify the characteristics of the layer or to obtain several concommitant reactions leading to a simultaneous layer constituted by a mixture adsorption or combination of various organic or inorganic bodies in the deposited coating. These modifications may be realised for the entire duration of the working of the bath or for a fraction of the duration.

Thus, use may be made of ordinary water to supersede, partly or in its totality, the distilled water in the composition of the bath and the progress of the treatment then undergoes a change. The use, in particular, of a water rich in lime sulfate gives tougher layers and more suitable to impregnation when light metals are treated.

Thus also, the addition of a soluble silicate at the end of the treatment may lead to an incorporation of silica into the coating. The coating then becomes suitable to be dyed in a basic dyeing bath. Additions of metallic salts such as chromium, manganese, titanium, tungsten, molybdenum salts or salts of metallic anions, chromates, manganates, titanates, tungstates, molybdates have some tendency to add to the coating layer more or less saline hydroxides in a more or less combined state.

Among the organic bodies, fatty acids and their salts such as stearic acid and stearates, when added to the bath, have some tendency to yield organic salts of the treated metals to the coating, and the coating layer becomes then water repellent.

Colloidal suspensions of resines, gum, latex, organic or inorganic matters added to the bath may be looked upon as auxiliary agents for the main treatment because these matters may be incorporated into the oxidized layer during its formation thus improving its properties.

Electrolysis and electrophoresis may be used to incorporate the improving agents into the coating layer.

Practice has shown that the physical state of the treated metal is of certain consequence for the characteristics of the protecting layer.

The preparation of the surfaces to be treated may comprise a cleaning or a scouring by known processes. When light metals are treated with a cyanide, the bath itself is scouring, and if the metal is not excessively dirty it need not otherwise be scoured.

It may become desirable to add in advance to an alloy a compound enabling it to form, after applying the aforementioned treatment, the best possible layer. Thus, in the case of aluminium alloys, the presence of copper and of magnesium is highly favourable to the production of strong coating layers.

Briefly, it is advantageous to eliminate any impurity which would be prejudicial, in a particular or in a general manner, to the strength of the coating layer. Practice has shown that any defect in the protecting layer is nearly always caused by a local impurity to which the treatment cannot be applied. In the absence of these impurities the coating layer is perfectly continuous. Even the holes, cracks and other defects in the continuity of the surface are coated with the protecting layer if no superficial inclusion hinders its formation. However, in the case of deep cavities where the bath would be renewed but with difficulty, it may be necessary to favour the regularity of the reaction by means of suitable stirring.

The protecting layers formed according to the invention are suitable to be dyed with organic or inorganic dyes. The fixation processes of dyes

on hydroxide layers or layers of basic salts are very well known and constitute the basis of the dyeing industry on fabrics. All that is known in this branch of industry may then be applied and more particularly auxiliary fixation treatments with acetates, solubilised oils and so on. In the case of layers principally made up of alumina which is amphoteric, the coating layer may fix either acid dyes or basic dyes. Practice has shown that the fixation of acid dyes is more readily realised. The aforementioned dyes may receive any addition liable to facilitate the fixation. In the case of alumina, for instance, some acid dyes fix well only in the presence of traces of acetic acid or of lime acetate.

For the proper working of the dyeing treatment it is necessary that the protecting layer should be fresh and humid. The treated metals must be kept in a water bath until the beginning of the dyeing operation and no longer.

A coating layer having lost its dyeing power recovers it after a new treatment which is the very same as the first and which may be of a shorter duration.

The dyeing treatment must be followed by a rinsing eliminating the excess of the dye and the additional substances incorporated into the dyeing bath, and more particularly acetic acid.

The protecting layers formed in accordance with the invention may be impregnated, in their thickness, with various substances in order that they may become stronger and water repellent. This impregnation eliminates the fortuitous defects of the protecting layer, the small holes of the layer being filled with the impregnation substance. In the case of layers having been dyed, the impregnation fixes the colouring matter. As impregnation substance, any dissolved or melted substance may be used which is capable of penetrating into the coating layer, with or without combination with the layer or the supporting metal.

Any dissolved substance aforementioned as being liable to be used in the bath yielding the coating layer may be incorporated into the bath. As the penetration of the substances is secured by the present water, it is advisable to obviate any drying of the layer between the two treatments, and the metals must be kept under water.

As example for a melted substance liable to be fixed by reaction on the coating layer, I may mention stearic acid, with or without additions of metallic stearates, which is fixed in consequence of the formation of basic aluminium stearate or of stearate of the supporting metal, and which imparts remarkable water repellent and anticorrosive properties to the protecting coating layer.

As example for substances of this kind, I may also mention linseed oil to which metallic linoleates, turpentine and natural or synthetic resines can eventually be added.

The impregnation with the melted substances is particularly efficient when working in the following manner: the substance is heated at the highest temperature it may support, as also the metal, without becoming injured. The metal kept under water since the treatment and slightly dried but still humid, is suddenly introduced into the melted bath where it is kept as long as vapour evolves. At the end of the vapour evolving, the piece is withdrawn, and the excess of the impregnation matter is wiped.

The adding of dyes to the melted substances enables the dyeing of the protecting coating. Thus, when stearic acid is used a dye soluble in melted stearic acid is added to the fatty matter.

The protecting layers formed in accordance with the invention may receive any treatment with a paint or varnish. The operations still described may specially be adjusted with a view to obtain a particularly good coating layer for this purpose.

The protecting coatings obtained by this invention enjoy very good dielectric properties. These properties will be improved by the aid of a melted insulating matter, and this operation enables to eliminate any trace of water and to stop up the holes on the coating layer. All the operations previously described may be adjusted in such a manner as to impart the best dielectric properties.

RENÉ MARIE BERTHIER.

Published June 8, 1943

Serial No. 273,526

ALIEN PROPERTY CUSTODIAN

INSULATED ELECTRIC CONDUCTORS

Jean Lepetit, Clichy, France; vested in the Alien Property Custodian

Application filed May 13, 1939

This invention relates to insulated electric conductors and has for its main object to provide an improved method of manufacture for the production of cables of flattened cross-section.

It has been proposed to subject a cable, insulated by a rubber coating of circular cross-section, to vulcanisation in a lead casing which is stripped off after the treatment has been completed. To this end the cable enclosed in the insulation is passed through a press which by extrusion through suitable dies, covers the insulation with a sheath or casing of regular thickness.

If this process is applied for the manufacture of cables of flattened cross-section, that is to say for example in which the cable, containing one or more conducting cores, has a rectangular cross-section, results are not satisfactory. In the first place covering such cable with a lead casing by means of a die press presents difficulties due, for example, to irregularity of spinning or congestion in the die. Even if the process is satisfactorily regulated the sheathing is insufficient to ensure a satisfactory mould during vulcanisation particularly on the major flat faces so that corresponding imperfections are produced on the corresponding faces of the insulation. Such imperfections are not only detrimental to the appearance of the cable but may result in local defects in the insulation thickness and may undesirably affect the cable as regards facility of rolling or stacking.

These difficulties are overcome by the present invention according to which the flat parts of the cable, particularly the major faces, are protected against the production of irregularities during the final moulding, for example during the vulcanisation treatment.

To this end these flat parts of the cable may, during moulding, be placed in contact with corresponding flat metallic elements of the sheath or casing, the said elements being of increased rigidity and having a perfectly smooth surface which, in consequence, ensures absolute regularity of the surfaces and thickness of the cable.

The flat elements may be provided in various ways. For example, a lead sheath may be applied whose transverse section is continuous about its periphery but whose thickness is varied in such a manner as to provide the inner surface with the necessary resistance, e. g. by thickening those walls of the sheath lying in contact with the major flat surfaces of the cable. According to another method hoops may be disposed within a sheath, of lead or the like, whose thickness is substantially constant on all sides and which is formed by spinning or extrusion.

According to a further method the sheath or casing of lead or the like suitably treated may be formed in separate parts, for example a trough-like part and a cover, the cable being laid in the trough-like part and the cover applied for example as by a clinched or besel joint. According to yet another method the cable may be wound in successive convolutions about a drum, a flat intermediate element or strip, for example of metal, being wound so as to lie between successive convolutions of the cable, the intermediate element being thus utilised on both its major faces. According to another method the cable is moved continuously between endless metallic bands which are juxtaposed so as to constitute a continuous mould which extends into or through the vulcanising chamber or zone.

In the accompanying drawings,

Figure 1 shows, in cross-section, one form of continuous spun sheath having an irregular thickness,

Figure 2 shows a multi-core cable in cross-section within a continuous sheath of constant thickness and spun with two stiffening or reinforcing foils,

Figures 3 and 4 are cross-sections of two further forms of sheath each constituted by separable parts,

Figures 5 and 6 show in side elevation and in axial section respectively a drum upon which a cable is wound when employing another method according to the invention,

Figure 7 shows diagrammatically the manner in which the cable and the intermediate element or strip are wound on the drum, and

Figures 8 and 9 illustrate, also diagrammatically, a further arrangement which employs endless bands.

Referring to Figure 1, the sheath shown is formed round the cable (including its insulation) by extrusion from a press, those walls of the sheath, which may be of lead or the like, lying adjacent to the two major flat faces of the cable being progressively thickened as shown. In Figure 2 metal foils **2** are fed from the press at the same time as the extruded sheath so that when the cable emerges the foils **2** are interposed between the major flat surfaces of the cable insulation **1** and the major flat inner surfaces of the sheath **3**.

When employing either the sheath shown in Figure 1 or that shown in Figure 2 the sheath is stripped off after the cable has been subjected to vulcanisation, the foils **2** (in the case of Figure 2) being removed at the same time as the sheath. In this way a remarkably true flat surface is formed on each flat side of the cable insulation whilst at the same time the thickness of the cable is maintained constant.

According to another method a trough may first be formed in which the cable is placed prior to the vulcanising treatment. For example, as shown in Figure 3 the mould comprises a trough-

like part comprising a thickened base 4 with sides 5 furnished with ledges 6 for cooperating with a flat cover 7 which is also thickened. The two thickened sides of the mould constituted by the base 4 and the cover 7 form reinforcements which bear respectively against the major flat surfaces of the cable insulation, the cover 7 being rctained in place by clinching over the ends 8 of the side walls 5. This operation may be effected by passing the mould containing the cable between the suitably shaped rollers of a press so as to ensure that the cover 7 is firmly locked to the trough. The interior surfaces 9 and 10 of the trough 4 and cover 7 are perfectly smooth and capable of resisting the forces applied during moulding and vulcanisation, so that the production if irregularities in the surfaces of the flat sides of the cable insulation during vulcanisation is obivated.

The trough-like part of the mould may be formed as shown in Figure 4 in which the two major or thickened walls 11 and 12 constitute part of the trough, the cover 13 constituting the fourth wall of the mould.

As shown in Figures 5, 6 and 7, the cable may be wound on a drum furnished with lateral cheeks, a metal band being wound between the convolutions of the cable. The cable thus lies at all points in engagement with metallic surfaces which are so juxtaposed as to constitute, in effect, a spiral mould whose cross-section is rectangular. Thus, on the one hand the flat surfaces of the cable are in contact respectively with two successive convolutions of the metal band and on the other hand the sides or edges of the cable are in contact with the surfaces provided by the two cheeks. In this arrangement the drum 14 is provided at a point in its periphery with a notch 15 connected to the cylindrical envelope by a helical ramp 15′ so that the second convolution of the cable and the interposed metallic strip will lie over the first convolution without the formation of any gap or space between them. The drum 14 is gripped between two side walls or cheeks 16, 16′, the cheek 16 being secured to the sleeve 17 whilst the cheek 16′ is secured to a sleeve 18 which can slide on the sleeve 17 so that the separation of the cheeks can be regulated as required. The drum 14 is constituted by a fixed cylinder secured in position by screws 19. The assemblage and the pressure may be ensured by a nut 34 provided with a key 35 and a driving part 36 of square cross-section to which the drive can be transmitted from a motor.

This apparatus may be employed for cables of all dimensions by a simple adaptation of the fixed cylinder and by suitably determining the dimensions of the intermediate metallic strip or band. A rack 20 may be provided which will cooperate with a suitable pawl thereby preventing unintentional unrolling of the convolutions on the drum. The drum may be driven by a belt 21 (Figure 7) or any other suitable means whilst the cable (including the insulation) is fed from between rollers 22 to the drum and the metallic band 25 is fed to the drum from a roll 24.

When the cable and intermediate metallic band or strip have been wound on the drum the necessary pressure between the cheeks 16 and 16′ adjacent to the outer periphery thereof is ensured by bolts 26 and spacers 27, the drum carrying the cable and metallic strip being then subjected to heat so as to vulcanise the cable insulation.

Figures 8 and 9 illustrate one form of apparatus whereby the vulcanisation can be carried out continuously. In this arrangement the cable 28 as it leaves the machine is engaged between four endless metallic bands 29, 30, 31, 32, which are so juxtaposed as to constitute a mobile mould of rectangular cross-section. The bands 29 and 31 constitute the major flat surfaces which are applied to the major flat faces of the cable insulation during vulcanisation, thus ensuring that these surfaces are free from irregularities and the cable thickness is constant. The smaller flat sides of the mould are constituted by the endless bands 30 and 32, the four endless bands being preferably so disposed adjacent to each other that, as shown in Figure 8, the longitudinal axis of each of them is slightly displaced with respect to the axis of the cable. In this way the endless bands will accurately adapt themselves relatively to each other and assure the required dimensions of the cable.

Having formed the mould as above described pressure members or guides 33 are arranged against the endless bands so that these will be accurately maintained against the cable with the correct spacing. The mobile mould thus formed extends through the vulcanisation chamber whose limiting walls are indicated by the lines *a—a* and *b—b*.

The invention includes as new industrial products not only the finished cables made by the method according to the invention but also the semi-finished product constituted by the insulated cable furnished with the temporary sheath or mould, and the mould itself.

The invention may be employed for the production of various forms of flattened or strip-like cable including a single conducting core or a number of conducting cores spaced apart in a plane parallel to the major cross-sectional axis of the cable.

According to a further feature of the invention the conducting core or cores of a flattened cable may be individually insulated and means provided between the individual insulation of each core and the main body of the surrounding insulation whereby this surrounding insulation is prevented from adhering to the insulation of the individual core or cores. To this end talc may be applied to the surface of the individual insulation of each core before moulding the insulated cores in the main body of insulation. In this way, extremities of the individual cores can retain their insulation right up to the point to which they are connected.

It will be understood, however, that whatever the internal arrangement of the core or cores within the main body of the insulation, the method according to the invention will ensure that in the case of a cable having four flat sides, the cable will be precisely rectangular so that the length of the cable can readily be superposed or juxtaposed within the minimum space. Moreover, the cable produced is very flexible and can be readily rolled and unrolled. When the cable produced is accurately rectangular in cross-section layers or lengths of the cable can easily be assembled in the form of precise geometric groups which can be readily maintained by means of supports such for example as clips or clamps. Particularly when such cables are stacked they do not have the tendency to slide one over the other since their flat faces lie exactly one on the other as opposed to cables having curved surfaces which would tend to slide off each other.

JEAN LEPETIT.

PUBLISHED JUNE 8, 1943. BY A. P. C.

J. LEPETIT

INSULATED ELECTRIC CONDUCTORS

Filed May 13, 1939

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2 Sheets–Sheet 1

Fig_6

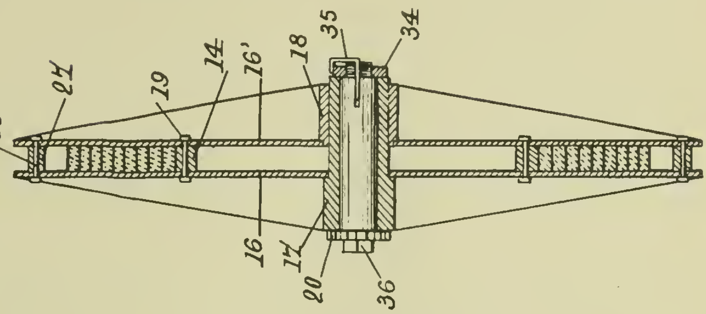


Fig_5

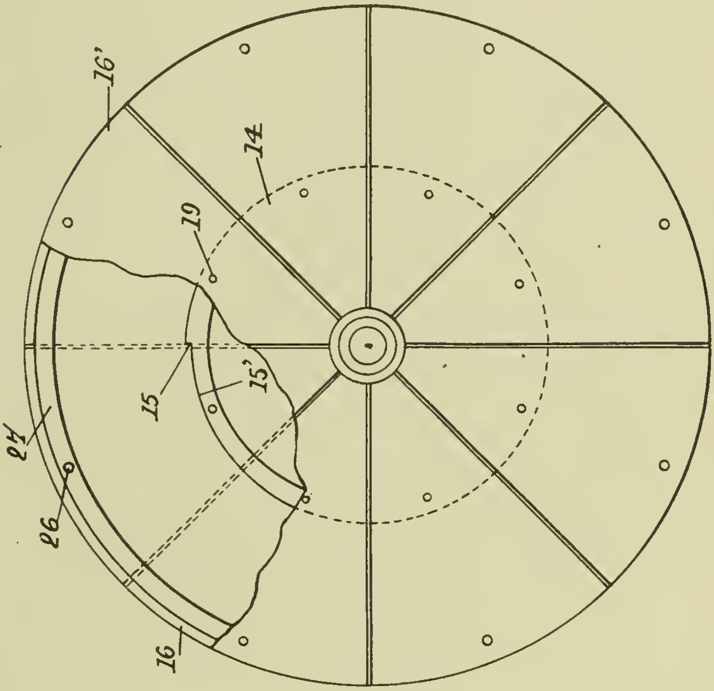
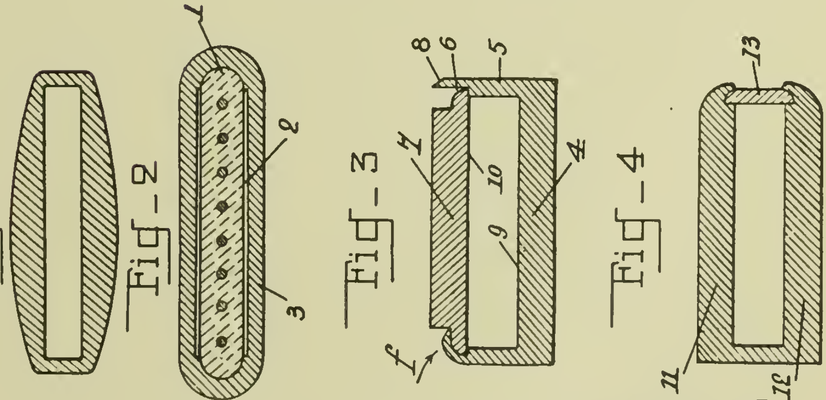


Fig_1

Fig_2

Fig_3

Fig_4



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2 Sheets-Sheet 2

Fig_7

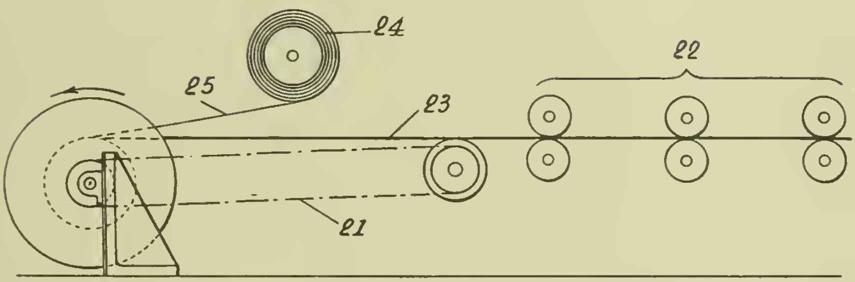


Fig_8

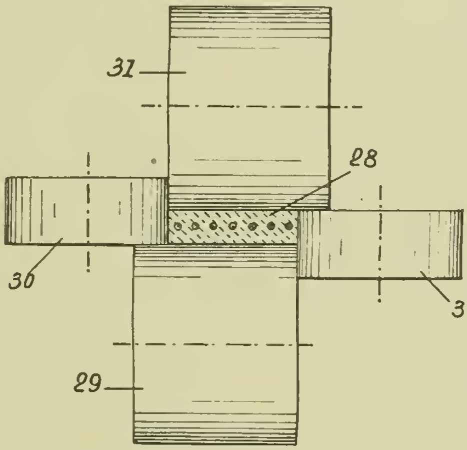
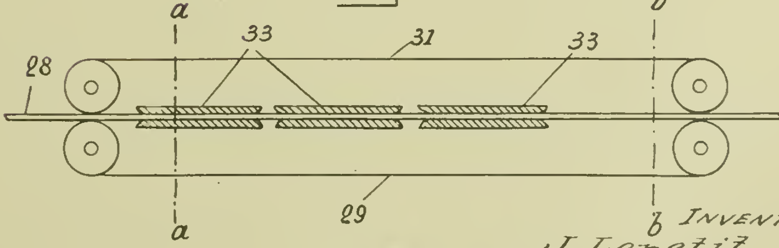


Fig_9



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ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF ELECTRIC CABLES OR OTHER INSULATED ELECTRIC CONDUCTORS FOR POWER CONDUCTION OR HEATING PURPOSES

Jean Lepetit, Clichy, France; vested in the Alien Property Custodian

No Drawing. Application filed May 24, 1939

This invention relates to the manufacture of an electric cable or other insulated conductor for power conduction or heating purposes having one or more conducting cores insulated from an outer metallic sheath by pulverulent mineral insulation, consisting for example of magnesia. It has been proposed in the manufacture of such cables or other conductors to introduce the insulating material into the sheath of a work-piece, from which the final cable or insulated conductor is made by a metallurgical treatment, such for example as drawing or rolling, in the form of completely dehydrated and compressed blocks. In practice, however, it is not found convenient to compress completely dehydrated powder, since the friction between the particles of the dehydrated powder and the walls of a mould in which the compression is to be effected renders difficult both the compression itself and the removal without fracture of the compressed blocks from the mould. Moreover the use of completely dehydrated powder also results in rapid wear of the mould.

Such difficulties are obviated in the process of the present invention, according to which the insulating powder is first "wetted" with a quantity of water or other liquid before it is compressed into the form of blocks to be inserted into the work-piece sheath.

This preliminary "wetting" treatment may be carried out by first adding sufficient liquid to the insulating powder to form a paste, which after thorough mixing is submitted to a controlled drying treatment to leave only the requisite quantity of liquid in the material, which is finally ground or crushed to bring it into the form of a "wetted" powder suitable for compression in the mould. The mould is so arranged that the compressed block has external dimensions to fit within the work-piece sheath and one or more holes to receive the core or cores of the work-piece.

It is to be understood that the terms "wetted" and "wetting" herein used do not necessarily imply that the "wetted" powder contains any free liquid, and in fact the powder will usually be dry but will have the desired total water content in the form of water physically or chemically combined in it. Moreover it is not always essential to the invention initially to add water or other liquid to the material and in some instances it may happen to be more convenient to obtain the material initially in a form containing an excess quantity of water, in which case the preliminary "wetting" treatment will serve to bring the material into the condition in which it has the requisite water content. The liquid used in the preliminary "wetting" treatment will usually be water, and it is to be noted that the term "dehydration" will for convenience be used herein even for cases where liquids other than water are used.

The dehydration is conveniently effected after compression by heating the compressed blocks in a furnace at a temperature sufficient to expel not only the water or other liquid initially added but also all traces of liquid (whether water of crystallisation or water or other liquid in suspension in or chemically combined in the material). The dehydrated compressed blocks are introduced from the dehydration furnace into the work-piece sheath.

After the blocks have been inserted into the work-piece sheath, the whole is preferably submitted to a preliminary metallurgical treatment by which the lateral dimensions of the sheath are reduced sufficiently to break down the blocks into the form of a homogeneous powder.

Thus the complete manufacturing process may comprise first "wetting" the insulating powder with a quantity of water or other liquid, compressing the "wetted" powder in the mould into the form of blocks having external dimensions to fit within the metallic sheath of a work-piece and bored to receive one or more conducting cores therein, heating the compressed blocks in a furnace to expel all traces of liquid therefrom, introducing the dehydrated compressed blocks into the work-piece sheath, submitting the whole to a metallurgical treatment to reduce the blocks into the form of a homogeneous powder, and finally submitting the so-formed work-piece to a drawing or rolling or other mechanical lengthening treatment to bring it to the required dimensions of the finished cable or other insulated conductor.

Further features of the invention relate to an electric cable or other insulated conductor manufactured by the above described process, and also to a block of compressed insulating material and to a work-piece constituting intermediate products of such process.

The invention may be carried into practice in various ways, but the following may be instanced as a preferred process according thereto for manufacturing an electric cable having magnesia insulation.

In this process it is convenient to employ commercial magnesia in the form of a relatively dry powder, which will usually contain a small proportion of magnesium hydrate with a total water content of say 5%. In order to facilitate compression of the powder in a mould, it is desirable

to increase the water content to about 25% and thus to form a "wetted" powder.

For effecting this preliminary "wetting" treatment, a quantity of water is first added to make the powder into a paste which is kneaded thoroughly to ensure proper binding of the paste. Since an excess quantity of water is required to make the paste, the kneaded paste is filled into metal carriers, wherein it is submitted to a carefully regulated drying treatment, the metal of the carriers being such as to avoid any undesired chemical reactions. The drying is so controlled as to leave in the material only the desired percentage of water, including water physically or chemically combined in the material. The caked contents of the carriers are then ground or crushed to reduce the material into the form of a moulding powder.

Instead of commencing the process with commercial magnesia and adding water thereto, it may be more convenient in some instances to start with magnesium hydrate and to proceed at once to the controlled drying treatment.

The moulding powder is filled into the moulds of a hydraulic press or other suitable compression machine, wherein it is submitted to pressure. The compression binds the powder into the form of blocks, which can readily be removed from the mould owing to the preliminary "wetting" treatment, and emerge with highly polished surfaces where they have been in contact with the walls of the mould. The compression mould is so shaped as to impart such dimensions to the blocks that they will fit closely within the interior of a metal tube forming the outer sheath of a work-piece, and also to form one or more holes through the blocks. If the blocks are to be used for the manufacture of a single-core cable, they will have one central hole of a size to fit the external dimensions of the conducting core of the work-piece, whilst for multicore cables the holes are spaced apart in relation to the sheath in accordance with the desired ultimate positions of the cable cores and have sizes to fit the conducting cores of the work-piece. The blocks, as they leave the moulds, are in a form in which (with reasonable care) they can be safely handled without risk of fracture.

Before introduction into the sheath of the work-piece the compressed blocks are submitted to a dehydration treatment, wherein all traces of liquid in them (whether it be water or other liquid in suspension or chemically combined in the material or water of crystallisation) are completely eliminated. This is effected by heating the blocks at white heat in a furnace. A temperature of about 800° C. for three hours will usually suffice for this purpose with an ample margin of safety.

Meanwhile the sheath and the conducting core or cores of the work-piece have been prepared for the reception of the dehydrated compressed blocks. The work-piece sheath will usually consist of a tube of copper having dimensions such as to give the required sheath dimensions to the finished cable after the lengthening treatment. In some instances however other ductile metals may be used for the sheath, as for example aluminium or an aluminium alloy preferably having an aluminium content greater than 98% or magnesium. The core or cores will usually be of copper, which may like-wise be replaced by another ductile metal such as those just mentioned. It is not essential that the same metal be used for both sheath and core and it may be preferable in some instances to use, say, an aluminium sheath and a copper core.

When the work-piece sheath has been prepared and the dehydration of the blocks has been completed, the blocks are forced in turn into position in the sheath.

The filled sheath is now submitted to a metallurgical treatment, for the purpose of reducing the blocks to powder within the sheath. Whilst this may be effected by a swaging or like treatment, it will usually be more convenient to employ a drawing or rolling or other lengthening treatment, one stage of which will commonly suffice for the purpose.

The work-piece is now ready for the final mechanical lengthening treatment, which is carried out in the well known manner, for example by drawing or rolling, in a series of stages with intermediate annealing after every few stages in order to maintain the necessary ductility in the sheath and core metals.

The finished cable has considerable advantages over other known types of cable. In the first place the insulation is homogeneous and uniform throughout the length of the cable and has a high insulation resistance, for example greater than 12,000 megohms per kilometre for a cable having an internal sheath diameter of 5 millimetres and a single core of 1.6 millimetres diameter. Moreover the insulation has high thermal conductivity, exceeding 15/000 watts per square centimetre per unit temperature gradient (one degree centigrade per centimetre thickness), and is such as to maintain the core or cores in their proper positions relative to the sheath, even when the cable is deformed, for example by hammering or by bending it round sharp corners. Further the cable has the important property of being fire-proof and incombustible, so that it can be raised to very high temperatures (within the limits of the melting points of the sheath and core metals) without risk of breakdown, and can carry very heavy currents without risk of faults likely to set fire to neighbouring structures.

Although it is preferred to use magnesia as the cable insulation, other insulating mineral powders may also be employed, if desired, the manufacture being carried out in a manner closely analogous to that above described.

The invention is also applicable to the manufacture of heating wires employing a relatively fine resistance wire in place of the robust conducting core or cores used in the cable manufacture. In this case, in order to prevent fracture of the resistance wire, the work-piece is initially made with dimensions not very greatly differing from the desired final dimensions, so that only one or very few stages of the lengthening treatment are required. Except for the use of the fine resistance wire, the process of making the work-piece in this case is generally the same as that above described for the cable, but in some instances the subsequent metallurgical treatment may consist merely of a swaging or rolling or other treatment sufficient to reduce the blocks to powder.

JEAN LEPETIT.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR MANUFACTURING GLASS ARTICLES

André Georges Charles Kirchheim, Aix La Chapelle, Germany; vested in the Alien Property Custodian

Application filed May 26, 1939

The invention relates to the manufacture of hollow glass articles formed by assembling a plurality of elements.

Amongst the known processes used for this purpose, the invention particularly relates to the process which consists in raising the elements to be assembled, or at any rate the parts of same located near the surfaces which are intended to come into contact, to a temperature at which the glass is capable of becoming welded to itself, and then pressing said elements against each other.

The carrying out in practice of this known process has hitherto encountered certain difficulties owing to the deformations which are detrimental to the article and which are liable to occur in the parts to be welded, either due to the pressure to be exerted on said elements for assembling same, or again to the high temperature which is almost the softening point of the glass and to which the elements have to be raised, at least in some of their parts. The efficiency of these processes may therefore be limited both by the necessity of not exerting too high a pressure and of not raising the parts to too high a temperature.

Consequently, there is a risk of the weld between the assembled elements not being perfectly fluid-tight, in particular when the contacting surfaces are of irregular shape or are unevenly faced.

The present invention has precisely for its object a process for manufacturing hollow glass articles, whereby a faultless weld of the assembled elements is obtained while eliminating the risks of deforming same during the assembling operation.

The process according to the invention consists in providing the surfaces of the glass elements which are intended to come into contact, with ribs, ridges or reliefs which are of such a shape and are so arranged that, at the instant when the elements come into contact, the projection of the surface of contact on a plane perpendicular to the direction of the movement of approach of the elements towards each other, is of smaller area than the area of the section of the elements through a plane parallel to the former but passing behind the ribs.

Owing to this particular configuration of the elements, when a force is exerted on same to press them against each other for assembling them, the pressure per unit area on the ribs or the like, at the instant when same come into contact, is greater than the pressure in the other sections which are located behind said ribs and are taken, in said elements, through planes that are perpendicular to the direction of the force exerted.

It follows from this that it is possible to calculate the pressure to be exerted and the temperature of the glass elements, in the immediate vicinity of the softening point, in such a manner as only to deform the ribs practically without deforming the elements to be assembled themselves.

Owing to this deformation of the ribs, it is possible to obtain an intimate contact between the elements to be assembled, in spite of the possible irregularities of shape of the contacting surfaces of said elements and thus to effect a fluid-tight weld of the elements to each other.

It has already been proposed to provide the contacting surfaces of the elements to be assembled, with ridges or with ribs, so as to prevent the slipping of one of the elements relatively to the other during the assembling operation, but in all these attempts, the projection of the contacting surface of the elements on a plane perpendicular to the direction of the movement of approach of the elements towards each other was not less than the section of the elements through a plane parallel to the former but located behind the ribs, so that at the location of the ribs the unit pressure was not greater than in the other parts of the elements. Consequently, the risk of deforming the elements themselves could not be avoided, since the correct assembling required too high a pressure.

Another advantage of the process according to the invention rests in the fact that by subjecting the edges of the elements, after manufacture and cooling, to re-heating, the ribs are automatically raised to a higher temperature than that of the body of the element, this result being due to the fact that the ribs are of smaller mass than said body itself.

This circumstance favours the welding, since it intensifies the main effect obtained by the shape of the ribs, as same are readily deformed by the effect of the pressure, without the body of the elements being itself liable to become deformed.

In the scope of the present invention, the ribs or other projecting parts, the dimensions of which are such that they only occupy a part of the width of the element surfaces that are intended to come into contact, may be of any shape. They may be limited by plane or curved surfaces; they may be provided with peaks or

with grooves and be arranged in any direction relatively to the edges of the elements to be assembled.

They may also be arranged in such a manner as to be located opposite each other when the elements are in contact, or again in such a manner that the ribs of one of the elements penetrate into the spaces left between the ribs of the other element. In numerous cases, it may suffice for only one of the surfaces which are intended to come into contact to be provided with ribs according to the invention.

It should be noted that, as in the prior assembling processes, the pressing of the elements to be assembled, against one anohter, may be obtained either by means of the actual weight of one of the elements, increased or not by an additional vertical pressure, or by means of a pressure exerted in any other appropriate direction, according to the position of the elements.

It should also be noted that when the ribs have to be ground to eliminate unevenness of shape or of surface, they only require a proportionally very small amount of work, owing to the fact that their cross-section is small relatively to the body of the elements to be assembled.

On the other hand, an advantageous method of carrying out the process consists, according to the invention, in effecting the heating of the two edges to be assembled, while same are in contact with each other and maintaining said heating while the assembling pressure is being exerted on the elements. Under these conditions, the heat required for raising the ribs to softening point penetrates inside the cavity of the article being formed and prevents the outer air from entering said cavity, thereby producing a very high vacuum inside the finished article.

The accompanying drawing gives a diagrammatical illustration of the characteristic process which has just been defined.

In said drawing:

Figs. 1, 2, 3 show, in section taken perpendicular to the general direction of the ribs, two partial views of elements to be assembled provided with ribs, the arrangement of which varies from one figure to the other.

Fig. 4 shows a partial front view of said elements.

In these figures, the ribs are placed in position for assembling, but before contact.

Figs. 5 and 6 show two modifications, likewise in section, the ribs being in this case brought into contact for assembling the elements.

Fig. 7 is a front view corresponding to Figs. 5 or 6.

Figs. 8 and 9 show two other modifications, the ribs being brought into contact for assembling.

Fig. 10 is a front view corresponding to Figs. 8 and 9.

In all these figures, the ribs are designated by a, a^1, the edges of the elements by b and the bodies of the elements by c.

In Figs. 1 to 4, the ribs a— or a^1— are straight.

Fig. 1 shows a single rib a on each of the edges b.

Fig. 2 shows two ribs a—a^1 per edge.

Fig. 3 shows one rib a on the edge of the upper element and two ribs a—a^1 on the edge of the lower element.

In the examples of Figs. 5 to 10, the ribs are of undulated or serrated longitudinal cross-section, the peaks s of one of them coming into contact with the bottoms v of the other.

In the device shown in Fig. 11 for welding the elements, the supports for each of the elements are designated by d and e, the elements by c, the burner by f and the device which enables the elements to be moved towards each other by g.

In the case of the manufacture of a hollow article formed by two elements, the same, after their manufacture and while they are still hot, are respectively mounted, as far as possible at the same time, in the supporting devices d and e. The ribs of the upper element and of the lower element are subjected to a short heating exerted in the present case by means of a burner f.

Owing to their relatively small thickness the ribs a, on which the heating action is concentrated, are raised to the softening temperature sufficiently quickly for the elements c themselves not to be influenced by said heating. When the ribs a have been made plastic, the elements c are moved towards each other by means of the sliding device g, in such a manner that they are brought into contact and welded by the action of a relatively small force, since although small said force suffices to develop a heavy pressure at the ribs.

When this assembling operation is effected on elements provided with a system of ribs which are not straight, of the kind of those shown in Figs. 5 to 10, the serrated or undulated edges of said ribs finally fit into each other owing to the deformation of the ribs, to such an extent that, in the finished article, the actual shape of the ribs can no longer be detected.

The finished hollow articles are then annealed or tempered according to the known methods.

As already pointed out at the outset, the heating can be maintained throughout the entire period during which the elements are placed in contact and pressed against each other. Under these conditions, at the beginning of the operation, as fluid-tightness is not obtained, hot gases penetrate inside the body which is being prepared; as soon as fluid-tightness becomes perfect, the internal atmosphere which has just been raised to a high temperature, is very rarefied, this advantageous result being to a large extent a direct consequence of the possibility of using very quick-acting burners, owing to the special configuration of the elements subjected to the heating.

ANDRÉ GEORGES CHARLES KIRCHHEIM.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

A. G. C. KIRCHHEIM
PROCESS FOR MANUFACTURING GLASS ARTICLES
Filed May 26, 1939

Serial No.
275,989
2 Sheets--Sheet 1

Fig. 1.

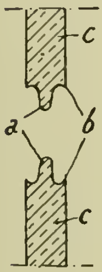


Fig. 2.

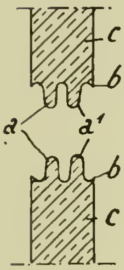


Fig. 3.

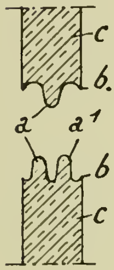


Fig. 4.

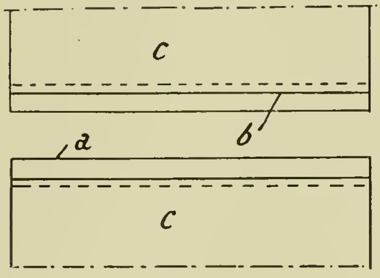


Fig. 5.

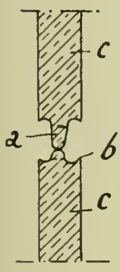


Fig. 6.

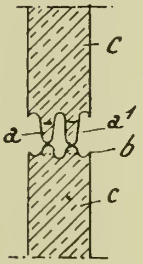


Fig. 7.

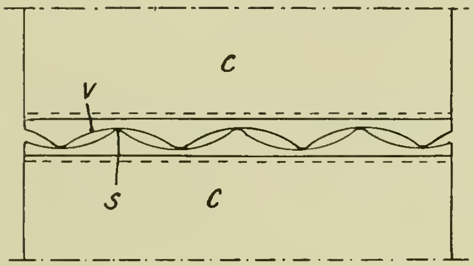


Fig. 8.

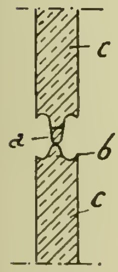


Fig. 9.

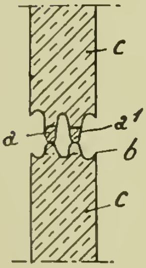
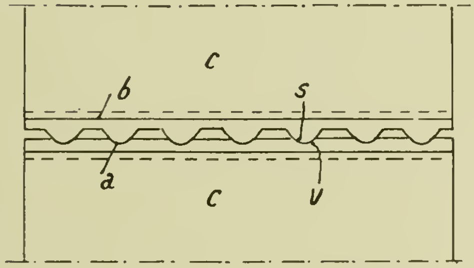


Fig. 10.



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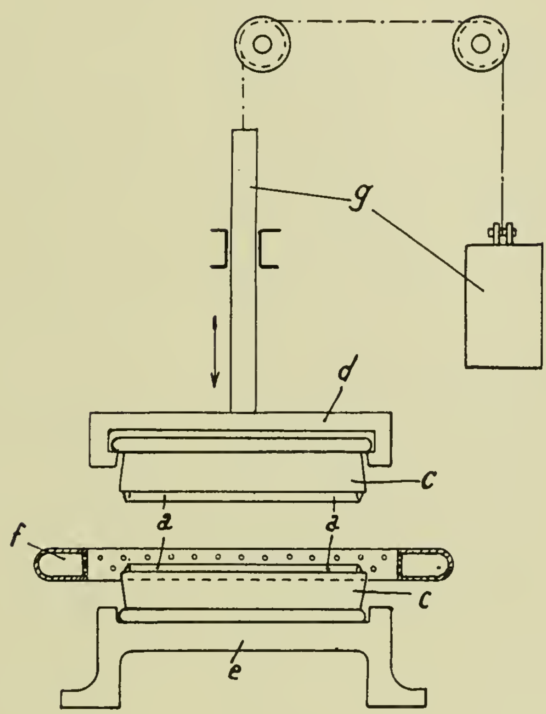
2 Sheets--Sheet 2

Fig. 11.



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Published June 8, 1943

Serial No. 280,439

ALIEN PROPERTY CUSTODIAN

INDICATING DEVICE FOR AIRSHIPS

Albert Patin, Berlin, Germany; vested in the Alien Property Custodian

Application filed June 22, 1939

This invention relates to a steering and indicating device for airships.

In prior art, horizon gyroscopes were provided at the instrument board of an airship to indicate directly the vertical and horizontal movements of an airship, and the indicators were operated by the movements of the inner and outer axes of the gyroscopes.

Devices of this type are not suitable for carrying out the remote steering of the ship, which should be as exact as possible and without steps. Furthermore, the devices attached to a gyro affect the movements thereof, particularly if they are provided with induction coils, and then the indications are not accurate. The gyroscope occupies a large part of the instrument board and disturbs the weight balance of the airship.

An object of the present invention is the provision of an indicating and/or steering device for airships which is operable in relation to both the vertical and the side movement of the ship and which is devoid of the above-stated drawbacks.

Other objects of the present invention will appear in the course of the following specification.

The objects of the present invention may be realized through the provision of a horizon gyroscope having three degrees of freedom and a vertical axis of rotation and one or more receiving devices situated at a distance therefrom and actuated thereby.

Both the inner and the outer axles or torque rods of the horizon gyroscope are provided with means utilizing the rotary movements of the axles to actuating corresponding indicating means in a receiving device.

In accordance with the present invention, the means transmitting the rotations of the gyro axles to indicating devices situated at a distance from the gyro and/or to the means used for automatically steering the ship, have the form of transmission potentiometers, each of which consists of an annular, preferably thin insulating body carrying a thin resistance wire which is wound axially winding to winding and which is in engagement with a sliding contact attached to one of the axles of the gyro.

The receiving device may occupy a very small space and be extremely light, which is of particular advantage in airship constructions. Furthermore, the same casing which contains the receiving devices responding to the movements of the two axles of the horizon gyroscope may also contain a receiving device which is operable by means actuated by the vertical axis of a course-indicating gyroscope, which is another gyroscope having three degrees of freedom and a rotary axis which extends normally in a horizontal direction.

In that case the same receiving or indicating device is also used for showing the deviations of the airship from a prescribed course. Thus the present invention provides a universal steering and/or indicating device, which may be used for operating or causing to operate simultaneously all the three rudders of an airship, namely, the side rudder, the transverse rudder and the height rudder.

Many different electrical transmission devices may be used for transmitting the rotations of the gyro axles to an electrical receiving device. In accordance with a preferred form of the present invention, a bridge connection is used for this purpose, by means of which the resistance ratio of two branches of a Wheatstone bridge is changed by the movements of a gyro axle and the bridge current resulting from this change of ratio is caused to flow through one or more coils in the receiving device, said coil or coils being rotatably mounted in a magnetic field and being used to actuate a contact which changes correspondingly the resistance ratio in the two other branches of the Wheatstone bridge, with the result that the electrical equilibrium of the bridge connection is reinstated.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings, showing by way of example a preferred embodiment of the inventive idea.

In the drawings:

Figure 1 is a diagrammatic view of a device constructed in accordance with the principles of the present invention, the two gyroscopes **1** and **39** being shown in plan view, with some parts broken off, while the casing **14** of the indicating device and the parts situated therein are shown in vertical section; and

Figure 2 is a front view of an indicating device built into the instrument board of an airship.

For the sake of clarity, all parts which are not necessary for the understanding of the operation of the device have been eliminated from the drawings.

The drawings illustrate a device wherein the turning movements of the gyro axles which do not amount to a complete revolution are transmitted electrically to an indicating device mounted upon an instrument board. Obviously, a similar construction may be employed for transmitting complete revolutions of the gyro axles.

Figure 1 shows a horizon gyroscope 1 having a rotary body 2 which is firmly connected with a vertical rotary axle 3. The axle 3 is carried by a frame 4, which extends on both sides of the body 2 and has horizontal connecting portions in which the axle 3 is mounted.

The frame 4 is firmly connected with two shaft portions or axles 5 having conical ends which are in alinement with each other and which are supported in sleeves formed in a frame 6. The annular frame 6 is firmly connected with two alined shaft portions constituting the outer axle 8, the conical ends of which are rotatably supported in a frame 7.

The horizon gyroscope 1 is so located within the airship that its inner axle 5 extends parallel to the longitudinal axis of the ship, while its outer axle 8 extends parallel to the transverse axis of the ship. Thus, the turning of the gyro about its inner axis 5 will indicate the transverse inclinations of the airship, while the movements of the gyro about the outer axis 8 will indicate the longitudinal inclinations of the airship.

Obviously, this arrangement may be reversed, and the movements of the gyro about its inner axis may indicate longitudinal inclinations, while the movements about the outer axis may indicate transverse inclinations of the ship.

In accordance with the present invention, the inner axle 5 as well as the outer axle 8 of the horizon gyro 1 are provided with means transmitting the turnings of the axles to a remotely situated receiving device.

In the described embodiment of the invention, the transmission of the movements takes place electrically.

A ring 9 made of insulating material is carried by the frame 6 in such manner that the central axis of the ring coincides with the longitudinal axis of the axle 5. The ring 9 carries windings of a conducting wire constituting an electrical resistance or a potentiometer 10. A sliding contact 11 is in engagement with the potentiometer 10 and is movable relatively thereto. The contact 11 is firmly connected with the inner axis 5 by means of a disc mounted upon the axle 5 and rotatable along with this axle; this disc carries an arm to which one end of the contact 11 is attached, while the opposite end of the contact is in engagement with the potentiometer 10.

Obviously, the contact 11 may be attached to the frame 4.

One end of the potentiometer 10 is connected by means of a conducting wire to a conducting ring 12 mounted upon the axle 8 and firmly connected therewith.

The opposite end of the potentiometer 10 is connected by a conducting wire to a conducting ring 13, which is also situated upon the axle 8 adjacent the ring 17 but which is separated therefrom by an insulating disc.

A sliding contact is in engagement with the ring 12, while another sliding contact is in engagement with the ring 13. These two sliding contacts are connected by wires to a main line 26 and 27 which are supplied with electrical current from a source not shown in the drawings. The main line is branched off by means of electrical wires which are firmly connected with two ends of a potentiometer 15 situated within the casing 14 of the receiving device.

The potentiometer 15 is similar in construction to the potentiometer 10 and is wound upon an insulating ring 16. The ring 16 is mounted upon one of the walls of the casing 14 and its longitudinal axis coincides with the central axis of a rotary coil 17 situated within the magnetic field of a magnet 18. The rotary coil 17 is provided with an arm carrying a contact 19, the free end of which is in engagement with the potentiometer 15 and slides over the windings of this potentiometer.

The coil 17 is firmly connected by means of a shaft with an indicating disc 20, which may have the form of a spherical surface, which is rotatable along with the coil 17 and which is visible through a glass carried by the casing 14, as shown in Figure 2.

The front surface of the disc 20, which is directed toward the observer, carries indicia 21 consisting of a pair of parallel lines symbolizing the wing surfaces of the airship, and a hand or pointer 22.

As shown in Figure 1, the contact 11 of the gyro 1 is electrically connected by wire with a conducting ring 23 which is firmly mounted upon the gyro axle 5 and is rotatable therewith. Another contact is in engagement with the conducting ring 23 and is connected by a wire with the conducting ring 24 which is firmly mounted upon the gyro axle 8 and is rotatable therewith. Another contact is in sliding engagement with the conducting ring 24 and is connected to a conducting wire 25 the opposite end of which is connected to a conducting ring which is not clearly shown in the drawings and which is mounted upon the axle of the coil 17. One end of the coil 17 is connected with the last-mentioned conducting ring. Thus, the contact 11 is electrically connected by means of a wire, the conducting ring 23, a contact, a wire, the conducting ring 24, another contact, the conducting wire 25, and another conducting ring with one end of the coil 17. The opposite end of the coil 17 is electrically connected with the sliding contact 19.

The wires connecting the rings 12 and 13 with the two ends of the potentiometer 15, are also connected with the main line 26 and 27 and are supplied with current from a source of electrical energy. It is apparent that the contact 11 divides the potentiometer 10 into two resistances, while the potentiometer 15 is similarly divided by the contact 19. These four resistances constitute a Wheatstone bridge.

The device is operated as follows:

Whenever the gyro 1 is caused to rotate around its axle 5, the contact 11 which is carried by a disc firmly connected with the axle 5, will also rotate along with the axle and its free end will slide over the potentiometer 10. Then the ratio of the two resistances which constitute the potentiometer 10 will be disturbed, with the result that an electrical current will flow through the contact 11 and the wire connecting it to the conducting ring 23. The electrical current will flow through the contact engaging the ring 23 and through the wire connecting it to the conducting ring 24. Since the wire 25 connects a contact which is in engagement with the ring 24 with a conducting ring not shown in the drawings and connected with the coil 17, the electrical current will flow through these elements to the coil 17 and thence to the contact 16.

The current flowing through the coil 17 will energize this coil, which is situated within the magnetic field created by the magnet 18. The electro-magnetic forces will act as a torque turning the coil 17 in the same direction in which the gyro axis 5 and the frame 4 connected therewith

are moved. The coil 17 will be subjected to this torque until the equilibrium in the Wheatstone bridge is restored. Since the extent of the angular movement of the coil 17 is equal to that of the axle 5, the disc 20 which is firmly connected with the coil 17 will reproduce the extent of movement of the axle 5 and consequently the extent of inclination of the airship. As already stated, the disc 20 and the indicia 21 carried thereby may be easily observed and the extent of inclination may be determined by the movement of the hand 22 over a scale 28 (Fig. 2). An inclination of the disc 20 is indicated diagrammatically in Figure 2 by the reference characters 21' and 22' representing new positions of the lines 21 and of the hand 22.

A potentiometer 29 (Fig. 1) which is exactly the same in construction as the potentiometer 10, is firmly connected to the frame 7 enclosing the gyro 1 and the axis of the potentiometer 29 coincides with the axis of the outer gyro axle 8. The two ends of the potentiometer 29 are connected to the main line 26 and 27 which are connected with two wires leading to the potentiometer 15. These wires are connected by other wires with two ends of a potentiometer 30 which is similar in construction to the potentiometer 29 and is attached to the casing 14 of the receiving device.

A contact 31 slides over the potentiometer 29 and is firmly connected with a disc which is rotatable along with the axle 8.

A contact 32 slides over the potentiometer 30 within the casing 14 and is firmly connected with one end of a rotary coil 33 which is rotatably mounted in the casing 14 and the axis of rotation of which coincides with that of the potentiometer 30. The coil 33 is situated within a magnetic field provided by a magnet 34 which is mounted within the casing 14. The opposite end of the coil 33 is connected with a conducting ring which is not shown in the drawings. This ring is connected with a conducting wire 35 the opposite end of which is electrically connected to a contact engaging a conducting ring 36 which is mounted upon the axle 8 and is rotatable therewith. The conducting ring 36 is connected by a wire with the contact 31 sliding over the potentiometer 29.

It is apparent that the potentiometers 29 and 30, the contacts 31 and 32, the coil 33 and the magnet 34 form a current-transmitting system which is of exactly the same type as the one previously described, and which operates as follows:

When the annular frame 6 of the gyro 1 is turned along with the outer gyro axle 8, the contact 31 will slide over the potentiometer 29, thus disturbing the electrical equilibrium of the Wheatstone bridge and causing an electrical current to flow through the contact 31, the conducting ring 36, the wire 35 and the coil 33. Electromagnetic forces caused by this current will turn the coil 33 within the magnetic field created by the magnet 34 and the turning movement of the coil 33 will be equal to the movement of the axle 8.

The coil 33 carries a double lever 37 extending on both sides of the magnet 18, the coil 17 and the disc 20 and carrying a transverse rod 38 which is situated in front of the disc 20 and is clearly visible to an observer, as shown in Figure 2. Since, as already stated, the gyro 1 is so arranged within the airship that its outer axle 8 is parallel to the transverse axis of the ship, the rod 38 which is movable relatively to a scale 39, will indicate the longitudinal inclinations of the airship.

The comparatively light casing 14 with the two electromagnetic systems situated therein and the indicators 20 and 38 may be easily built into the instrument board and will serve as a complete substitute for the heavy horizon gyroscope which would occupy considerably more room.

The casing 14 containing the indicating instruments is preferably provided with a further receiving device which is operated by a course gyroscope 39, shown in Figure 1.

The body 40 of the gyroscope 39 is supported by a horizontal rotary axle 41 the two ends of which are rotatably supported in a horizontal annular frame 42. The frame 42 is rotatably supported by the axle 43, which extends horizontally and at right angles to the axle 41. The two ends of the axle 43 are rotatably supported in a vertical frame 44. The frame 44 is provided with a bridge portion carrying a vertical axle 45 which is rotatably supported in a frame not shown in the drawings.

Since the frame 44 has the tendency to retain its original position in space, any rotary movements of this frame about the axis of the vertical axle 45 will indicate the course of the airship.

The axle 45 carried in the frame 44 is provided with electrical transmitting means which are similar to those described:

A potentiometer 46 surrounds the axle 45. A contact 47 slides over the potentiometer 46 and is attached to the axle 45, although, obviously, it may be attached to the frame 44.

The contact 47 is connected with a conducting ring 48 which is mounted upon the shaft 45 and is rotatable therewith. Another contact is in engagement with the conducting ring 48 and is connected by a wire 49 to one end of a coil 50 which is rotatably mounted within the casing 14 and is situated in a magnetic field created by a magnet 51.

The opposite end of the coil 50 is connected with a contact 52 which is supported by the coil 50 and which is slidable over a potentiometer 53 which is firmly attached to a wall of the casing 14.

The two ends of the potentiometer 53 are connected to wires leading to the main line 26 and 27. The main line 26 and 27 is connected by wires with the two ends of the potentiometer 46. Thus the potentiometer 46 and the coil 50 are electrically connected with each other and to a source of electrical energy.

The described system also forms a Wheatstone bridge which operates in the following manner:

As soon as the mechanical equilibrium of the gyroscope 39 is disturbed and the shaft 45 is rotated, an electrical current will flow through the contact 47, the conducting ring 48 and the wire 49 to the coil 50, so that the coil 50 will be rotated within the magnetic field of the magnet 51.

The coil 50 carries a hand 54, which is shown in Figure 2. and is visible to an observer. This hand 54 will therefore indicate to an observer all the changes in the direction of an airship. When the ship is flying along the desired course, the hand 54 will be situated over a line 55 provided upon a scale 62. Any deviation of the ship from a set course will result in the movement of the hand 54 to the left or to the right from the mark 55.

The potentiometer 46 may be adjusted in rela-

tion to the course gyro 39 and thus the neutral position of the coil 50 and of the hand 54 connected therewith may be also adjusted.

For the purpose of providing this adjustment, the potentiometer 46 is carried by a disc 56, which may be rotated relatively to the gyro frame. The adjustment of the potentiometer 46 is carried out by means of a motor 57 which is operable by the switches 58 and 59 and is connected to a battery. The motor shaft of the motor 57 carries a conical gear wheel which meshes with another conical gear wheel carried by a shaft having a worm which meshes with a worm gear firmly connected to the disc 56. The two switches 58 and 59 are used for rotating the shaft of the motor 57 in opposite directions.

It is also possible to provide an adjustment by means of a rotary button 60 which is carried by the casing 14 and is situated in front of the glass carried by said casing, as shown in Figure 2. The rotary button 60 may be connected to a shaft 61, which may consist of an elastic or bendable material and the opposite end of which carries a conical gear wheel meshing with that gear wheel, which drives the disc 56.

The course-indicating scale 62 is situated within the casing 14 and is connected with the button 60. Due to this arrangement, the course taken by the ship may be easily determined and the correct course is indicated when the hand 54 is situated in alinement with the line or mark 55 carried by the annular scale 62.

It is also advantageous to provide a tubular level 63 (Fig. 2) over the scale 62, the bubble 64 of which shows the apparent transverse inclination of the airship.

Due to the described arrangement, the casing 14 with the indicating devices contained therein serves as a universal indicator, which shows all the necessary data to the pilot of the ship. It occupies considerably less space than prior art constructions upon the instrument board and is considerably lighter.

Devices of the described type may be used not only to indicate rotations of the gyro axles up to a certain angle which is less than 360°, but also to indicate any rotations of the axles, even those which exceed 360°. These two types of indicators may be conveniently used for the purposes of the present invention, depending upon as to whether the indicating device should show an absolute flight position in space with reference to a certain axis or whether it should merely indicate a relative position of the ship with reference to an axis or whether it deviates from that axis.

In many instances it suffices to use simple indicators which merely show deviations from a certain predetermined position. However, a system showing the true position of the ship in space is necessary whenever an indicator is required which is suitable for exhibition flights, and which should show the correct position of the ship in the course of rollings, loopings and the like.

A simple course indicator of the described type is sufficient for commercial aircraft, particularly since the annular scale 62 and the hand 54 are both adjustable. The indicia 55 which should coincide with the hand 54 is also used to indicate the correct course.

A further advantage of the described construction, in addition to the saving of place on the instrument board, consists in that the pilot need only observe one instrument instead of following the indications of two instruments, as in prior art constructions.

As already stated, the described indicating device may be also used as an automatic steering device in order to provide automatic steering about one or all ship axes. Such automatic steering device includes relays of the same type as those described and therefore the illustrated construction may be easily adapted for steering by the use of electrical, electro-pneumatic or electro-hydraulic intermediate relays which may be used for operating the rudder motors of the ship and may be connected in parallel to the potentiometer relays upon the axles of the gyros.

If independent steering is desired, which would be separate from the indicating devices, each of the axles of the gyros may be provided with a separate potentiometer for the respective rudder motor.

Many other variations and modifications may be made in the described structures without departing from the scope or intent of the present invention.

ALBERT PATIN.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

A. PATIN

INDICATING DEVICE FOR AIRSHIPS

Filed June 22, 1939

Serial No. 280,439

2 Sheets-Sheet 1

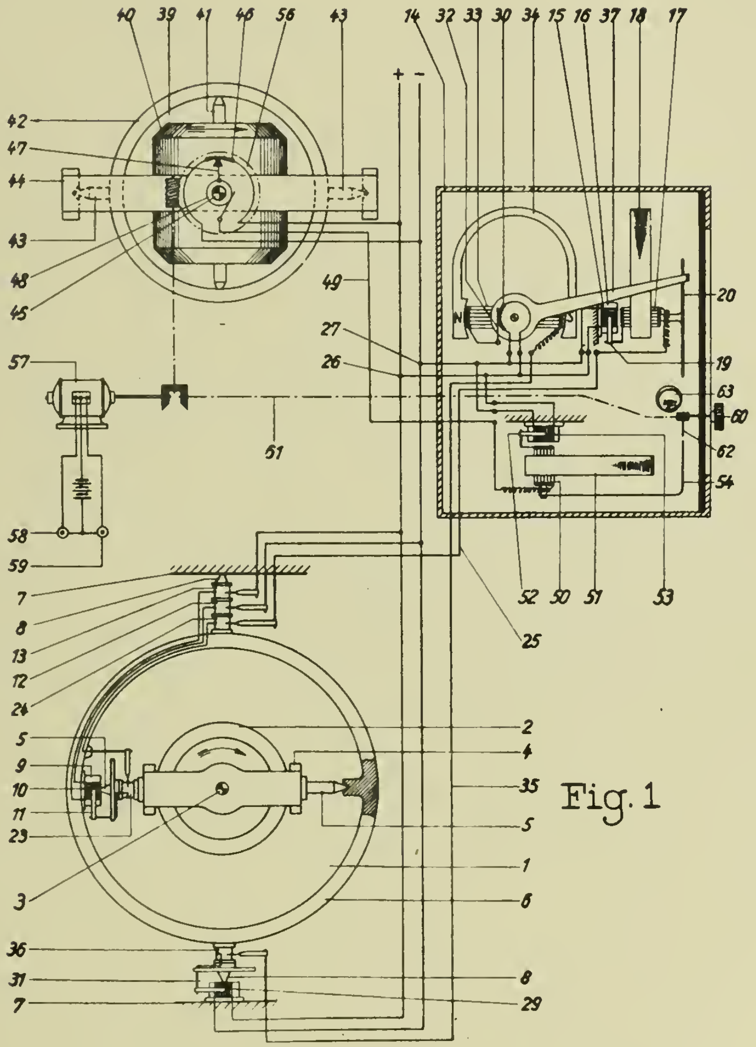

Fig. 1

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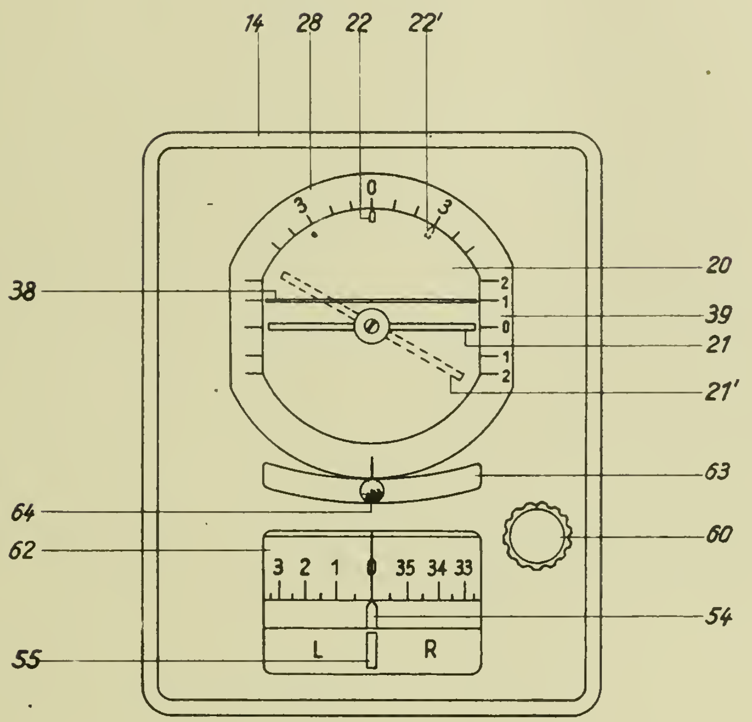

Fig. 2

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Published June 8, 1943

Serial No. 285,390

ALIEN PROPERTY CUSTODIAN

INSULATED ELECTRIC CONDUCTORS

Jean Lepetit, Clichy, France; vested in the Alien Property Custodian

Application filed July 19, 1939

This invention relates to insulated electric conductors and has for its main object to provide an improved method of manufacture for the production of cables of flattened cross-section.

It has been proposed to subject a cable, insulated by a rubber coating of circular cross-section, to vulcanization in a lead casing which is stripped off after the treatment has been completed. To this end the cable enclosed in the insulation is passed through a press which by extrusion through suitable dyes, covers the insulation with a sheath or casing of regular thickness.

If this process is applied for the manufacture of cables of flattened cross-section, that is to say for example in which the cable, containing one or more conducting cores, has a rectangular cross-section, results are not satisfactory. In the first place covering such cable with a lead casing by means of a die press presents difficulties due, for example, to irregularity of spinning or congestion in the die. Even if the process is satisfactorily regulated the sheathing is insufficient to ensure a satisfactory mould during vulcanization particularly on the major flat faces so that corresponding imperfections are produced on the corresponding faces of the insulation. Such imperfections are not only detrimental to the appearance of the cable but may result in local defects in the insulation thickness and may undesirably affect the cable as regards facility of rolling or stacking.

These difficulties are overcome by the present invention according to which the flat parts of the cable, particularly the major faces, are protected against the production of irregularities during the final moulding, for example during the vulcanization treatment.

To this end these flat parts of the cable may, during moulding, be placed in contact with corresponding flat metallic elements of the sheath or casing, the said elements being of increased rigidity and having a perfectly smooth surface which, in consequence, ensures absolute regularity of the surfaces and thickness of the cable.

The flat elements may be provided in various ways. For example, a lead sheath may be applied whose transverse section is continuous about its periphery but whose thickness is varied in such a manner as to provide the inner surface with the necessary resistance, e. g. by thickening those walls of the sheath lying in contact with the major flat surfaces of the cable. According to another method hoops may be disposed within a sheath, of lead or the like, whose thickness is substantially constant on all sides and which is formed by spinning or extrusion.

According to a further method the sheath or casing of lead or the like suitably treated may be formed in separate parts, for example a trough-like part and a cover, the cable being laid in the trough-like part and the cover applied for example, as by a clinched or besel joint. According to yet another method the cable may be wound in successive convolutions about a drum, a flat intermediate element or strip, for example of metal, being wound so as to lie between successive convolutions of the cable, the intermediate element being thus utilized on both its major faces. According to another method the cable is moved continuously between endless metallic bands which are juxtaposed so as to constitute a continuous mould which extends into or through the vulcanizing chamber or zone.

In the accompanying drawings,

Figure 1 shows, in cross-section, one form of continuous spun sheath having an irregular thickness,

Figure 2 shows a multi-core cable in cross-section within a continuous sheath of constant thickness and spun with two stiffening or reinforcing foils,

Figures 3 and 4 are cross-sections of two further forms of sheath having separable parts,

Figures 5 and 6 show in side elevation and in axial section respectively a drum upon which a cable is wound when employing another method according to the invention,

Figure 7 shows diagrammatically the manner in which the cable and the intermediate element or strip are wound on the drum, and

Figures 8 and 9 illustrate, also diagrammatically, a further arrangement which employs endless bands.

Referring to Figure 1, the sheath shown is formed round the cable (including its insulation) by extrusion from a press and those walls of the sheath, which may be of lead or the like, lying adjacent the two major flat faces of the cable are progressively thickened as shown. In Figure 2 metal foils **2** are fed from the press at the same time as the extruded sheath so that when the cable emerges the foils **2** are interposed between the major flat surfaces of the cable insulation **1** and the major flat inner surfaces of the sheath **3**.

When employing either the sheath shown in Figure 1 or that shown in Figure 2 the sheath is stripped off after the cable has been subjected to vulcanization. The foils **2** (in the case of Figure 2) are removed at the same time as the sheath. In this way a remarkably true flat surface is formed on each flat side of the cable insulation while at the same time the thickness of the cable is maintained constant.

According to another method a trough may first be formed in which the cable is placed prior to the vulcanizing treatment. For example, as shown in Figure 3 the mould comprises a trough-like part comprising a base **4** which is thicker than the sides **5**. The sides **5** are furnished with ledges **6** for cooperating with a flat cover **7** which

is also thicker than the sides 5. The two thicker sides of the mould constituted by the base 4 and the cover 7 bear respectively against the major flat surfaces of the cable insulation. The cover 7 is retained in place by clinching over the ends 8 of the side walls 5. This operation may be effected by passing the mould containing the cable between suitably shaped rollers of a press so as to ensure that the cover 7 is firmly locked to the mould. The interior surfaces 9 and 10 of the base 4 and the cover 7 are perfectly smooth and capable of registering the forces applied during moulding and vulcanization, so that the production of irregularities in the surfaces of the flat sides of the cable insulation during vulcanization is obviated.

The mould may be formed as shown in Figure 4 with two major or thickened walls 11 and 12 and the cover 13 forming a side wall of the mould.

As shown in Figures 5, 6 and 7, the cable may be wound on a drum furnished with lateral cheeks. A metal band is wound between the convolutions of the cable. The cable thus lies at all points in engagement with metallic surfaces which are so juxtaposed as to constitute, in effect, a spiral mould whose cross-section is rectangular. Thus, on the one hand the flat surfaces of the cable are in contact respectively with two successive convolutions of the metal band and on the other hand the sides or edges of the cable are in contact with the surfaces provided by the two cheeks. In this arrangement the drum 14 is provided at a point in its periphery with a shoulder 15 and the periphery is a helical ramp 15′ so that the second convolution of the cable and the interposed metallic strip will lie over the first convolution without the formation of any gap or space between them. The drum 14 is located between two side walls or cheeks 16 and 16′. The cheek 16 is secured to the sleeve 17 while the cheek 16′ is secured to a sleeve 18 which can slide on the sleeve 17 so that the spacing of the cheeks can be regulated as required. The drum 14 is constituted by a fixed cylinder secured in position by bolts 19. The assemblage and the pressure may be ensured by a nut 34 provided with a key 35 and a driving part 36 of square cross-section to which the drive can be transmitted from a motor.

This apparatus may be employed for cables of all dimensions by a simple adaptation of the fixed cylinder and by suitably determining the dimensions of the intermediate metallic strip or band. A ratchet 20 may be provided which will co-operate with a suitable pawl thereby preventing unintentional unrolling of the convolutions on the drum. The drum may be driven by a belt 21 (Figure 7) or any other suitable means while the cable (including the insulation) is fed from between rollers 22 to the drum and the metallic band 25 is fed to the drum from a roll 24.

When the cable and intermediate metallic band or strip have been wound on the drum the necessary pressure between the cheeks 16 and 16′ adjacent to the outer periphery thereof is ensured by bolts 26 and spacers 27. The drum carrying the cable and metallic strip is then subjected to heat so as to vulcanize the cable insulation.

Figures 8 and 9 illustrate one form of apparatus whereby the vulcanization can be carried out continuously. In this arrangement the cable 28 as it leaves the machine is engaged between four endless metallic bands 29, 30, 31 and 32, which are so positioned as to constitute a mobile mould of rectangular cross-section. The bands 29 and 31 constitute the major flat surfaces which are applied to the major flat faces of the cable insulation during vulcanization, thus ensuring that these surfaces are free from irregularities and the cable thickness is constant. The smaller flat sides of the mould are constituted by the endless bands 30 and 32. The four endless bands are preferably so disposed adjacent each other that, as shown in Figure 8, the longitudinal axis of each of them is slightly displaced with respect to the axis of the cable. In this way the endless bands will accurately adapt themselves relatively to each other and assure the required dimensions of the cable.

Having formed the mould as above described pressure members or guides 33 are arranged against the endless bands so that these will be accurately maintained against the cable with the correct spacing. The mobile mould thus formed extends through the vulcanization chamber whose limiting walls are indicated by the dot and dash lines *a—a* and *b—b*.

The invention includes as new industrial products not only the finished cables made by the method according to the invention but also the semi-finished product constituted by the insulated cable furnished with the temporary sheath or mould, and the mould itself.

The invention may be employed for the production of various forms of flattened or strip-like cable including a single conducting core or a number of conducting cores spaced apart in a plane parallel to the major cross-sectional axis of the cable.

According to a further feature of the invention the conducting core or cores of a flattened cable may be individually insulated and means provided between the individual insulation of each core and the main body of the surrounding insulation whereby this surrounding insulation is prevented from adhering to the insulation of the individual core or cores. To this end talc may be applied to the surface of the individual insulation of each core before moulding the insulated cores in the main body of insulation. In this way, extremities of the individual cores can retain their insulation right up to the point at which they are connected.

It will be understood, however, that whatever the internal arrangement of the core or cores within the main body of the insulation, the method according to the invention will ensure that in the case of a cable having four flat sides, the cable will be precisely rectangular so that the length of the cable can readily be superposed or juxtaposed within a minimum space. Moreover, the cable produced is very flexible and can be readily rolled and unrolled. When the cable produced is accurately rectangular in cross-section layers or lengths of the cable can easily be assembled in the form of precise geometric groups which can be readily maintained by means of supports such for example as clips or clamps. Particularly when such cables are stacked they do not have the tendency to slide over one another since their flat faces lie exactly one on the other contrary to cables having curved surfaces which would tend to slide off each other.

This application is a division of application, Serial No. 273,526 filed May 13, 1939.

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2 Sheets-Sheet 1

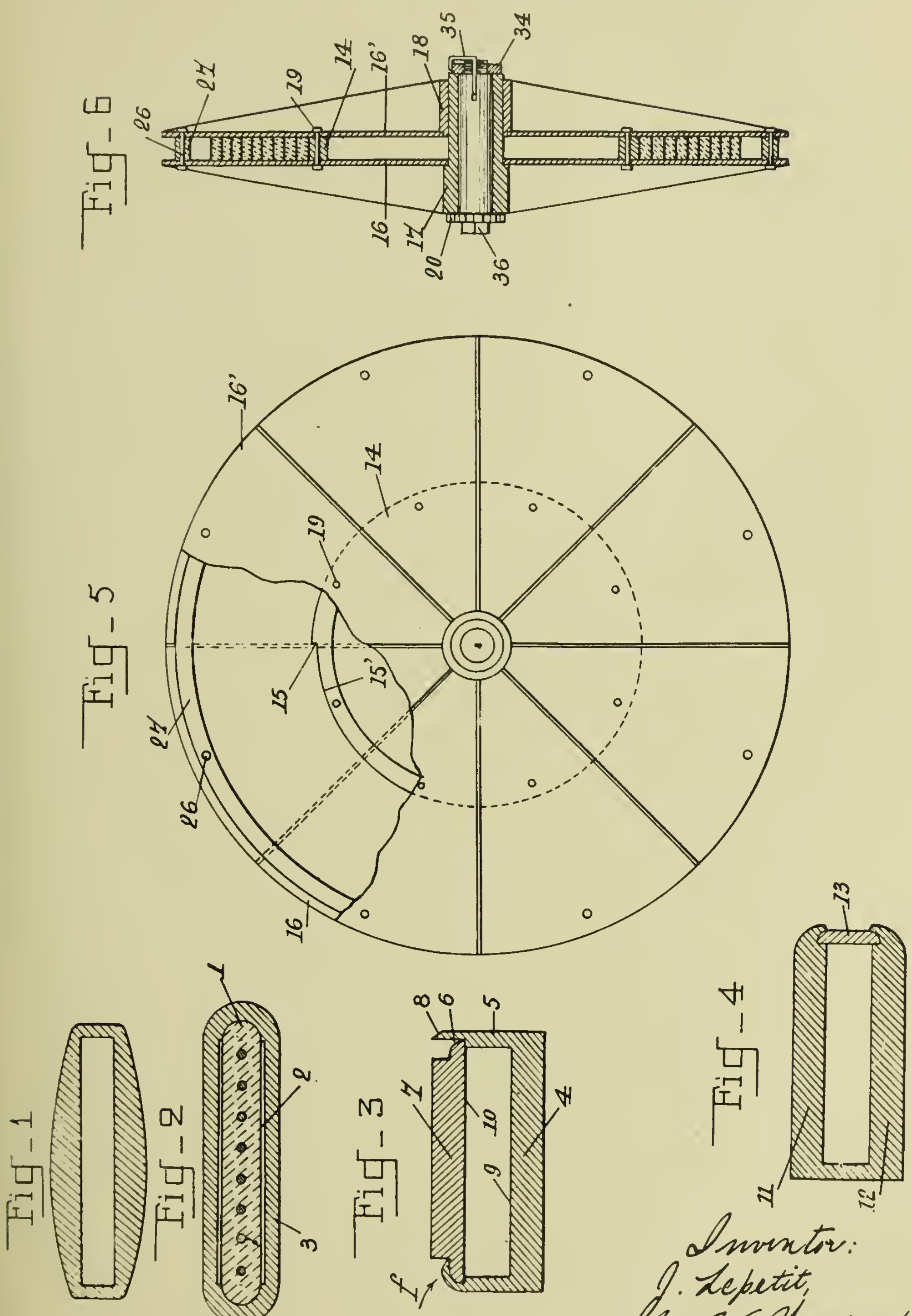

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Fig_7

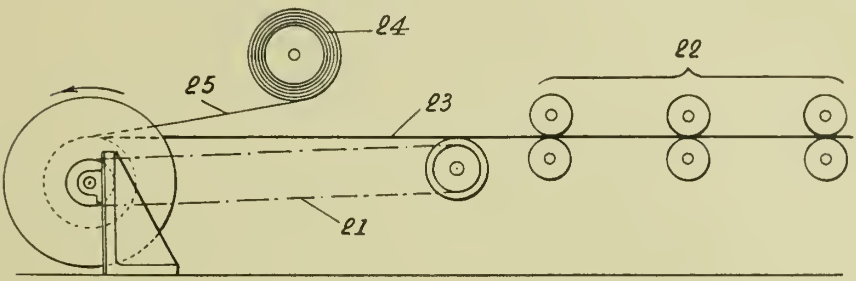


Fig_8

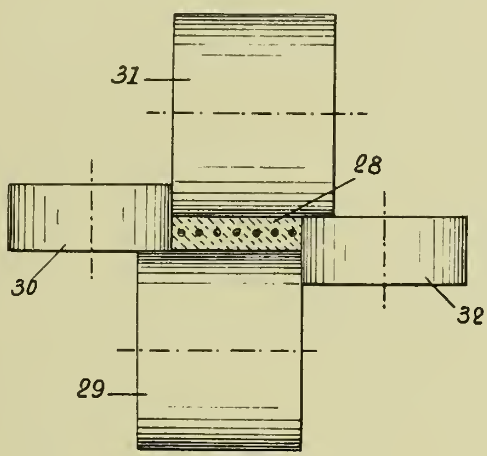
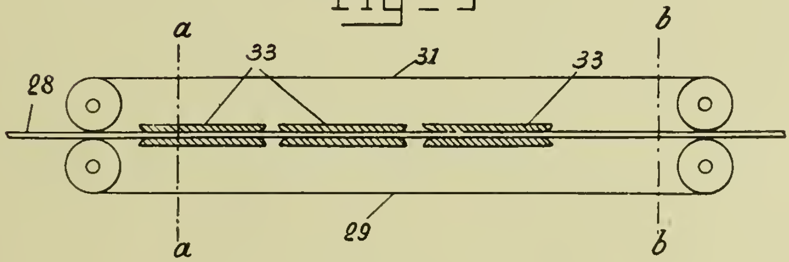


Fig_9



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ALIEN PROPERTY CUSTODIAN

INJECTION NOZZLE FOR INTERNAL COMBUSTION ENGINES

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Application filed July 22, 1939

The invention relates to closed fuel-injection nozzles.

An important object of the invention resides essentially in that a cylindrical body serving as a guide is connected to the lower end of the nozzle valve or needle directly at the valve seating, this body being separated from the nozzle wall by a fine cylindrical gap only, and that a second guide is provided at the opposite, upper, end of the valve or needle. By the design of the nozzle valve or needle mounting in accordance with the invention, fluttering of the nozzle valve or needle is reliably avoided in all engines especially fast-running engines.

According to a further object of the invention the upper guiding body of the valve or needle serves at the same time as an abutment for the valve spring. Preferably the guiding body for the valve stem or the spring abutment is adjustable.

According to a still further object of the invention, a short annular gap is provided in front of the valve seating. In this fashion, the danger, which exists with a long bore above the valve seating, of jamming or burning up or caking of the nozzle needle or valve is avoided.

A still further object of the invention is to provide for the guidance or conducting of the fuel by the arrangement in the cylindrical guide member behind the valve seating, of bores disposed radially or upon a conical surface these bores opening into a collecting passage located, for example, along the axis of the valve or needle. Preferably the number of bores amounts to not less than two and not more than four. An annular gap between the cylindrical guide member and the nozzle bore is not necessary, since the fuel is supplied through the passages only. The injection nozzles in accordance with the invention belong to the class which do not require a special discharge of leakage oil.

Several embodiments of the inventive idea are illustrated by way of example in the accompanying drawings in which:

Figure 1 shows in longitudinal section a nozzle through which the fuel passes between the cylindrical guide part of the valve or needle and the nozzle bore,

Figures 2 and 3 are similar views, and Figure 4 is a detached view of a valve, illustrative of nozzles with passages for the fuel in the cylindrical part of the valve or needle, and

Figure 5 illustrates a modification comprising a throttling collar above the valve seating.

In the constructional example according to Figure 1, the body of the injection nozzle consists of an intermediate nut member 1 with upper and lower spigots 2, 3 provided externally with threads. The nozzle body has a wide bore 4 and is furnished at the bottom with a base 5 surrounding the valve passage. This valve passage consists of a short bore part 6 which widens downwardly to form a conical valve seating 7 which finally runs into a cylindrical bore part 8. Resting against the valve seating 7 is a valve body 10 which is arranged at the lower end of the stem 9 of the valve or needle and which, in the region of the bore 8, likewise runs into a cylindrical form 11, there being a fine cylindrical gap at this point. Between the stem 9 and the wall of the valve passage 6 is a large annular gap 12 of such nature that, firstly, the fuel can flow in large quantities to the valve seating 7 and, secondly, settlement of resinified oil at this point or jamming of the stem or needle 9 when the nozzle is screwed in is prevented. The upper end of the valve stem is provided with a threaded part 13. Screwed upon the latter, are an abutment member 14 for a valve spring 15 and a lock nut 16. The valve spring 15 is located in the bore 4, likewise with such clearance that its coils nowhere touch the cylindrical wall of the bore 4. Its upper end bears against the abutment 14 on the valve stem and its lower end bears against the base 5. The spring abutment 14 slides in the bore 4 and serves at the same time as a guide for the valve stem 9. Furthermore, the abutment member 14 at the same time assists or relieves the guiding action of the valve body 11 and provides for a uniform width of gap at this point. Furthermore, the guide member 14 has longitudinal bores or recesses 17 which connect the spring chamber 4 with the space above such guide member. A cap or bushing 18, which extends the bore 4 and whose top or cover part 19 has a coned central hole 20, is mounted upon the threaded spigot 2 of the injection-nozzle body. The central hole 20 receives the terminal cone 21 of the fuel supply duct or passage 22, this cone being pressed tightly against the cover 19 by a cap 23 screwed upon the threaded spigot 2. In this manner, the intermediate bushing 18, 19, which by itself is loosely mounted, is at the same time held firmly upon the threaded spigot 2.

In the form of construction according to Figure 2, there is mounted in an outer nozzle body 40 an inner nozzle body 41 with the bore 4 which is closed at the bottom by the base 5 in which the valve passage is located. This passage con-

sists of a short cylindrical bore part 6, the valve seating 7 and a cylindrical bore part 8.

Guided in the said bore part 8 is the cylindrical guide member 11 of the valve or needle which is followed by the conical valve seating surface 10 and the stem 9 of the valve. The upper part of the valve or needle stem forms the guide 42 which is mounted in the guide member 14. The valve spring 15 which bears at the bottom against the base 5 and above at the top bears against the guide member 14 is stressed by means of the nuts 16 screwed upon the threaded part 13 of the valve or needle stem. Recesses 43 or longitudinal bores for the passage of the fuel are cut in the guideway for the member 14. The longitudinal recesses or bores may also be cut in the guide member 14, in which case the bore 4 may then be made smooth with a constant diameter. By the form of construction illustrated in Figure 2, the lower closure edge 37 of the guideway serves in simple fashion as abutment for the guide member 14 and consequently as a means for limiting the stroke of the nozzle needle. The stroke of the nozzle needle is indicated at 50.

In accordance with the same form of construction, passages 44 located upon an imaginary conical surface are bored in the cylindrical guide 11 of the nozzle valve or needle from the end nearer the valve seating. These passages run, for example at the axis of the nozzle, into a passage 45 which opens into a conical recess 46.

The inner nozzle body 41 is forced into the outer body 40 by the screw device 46 which encloses a hollow space 47 for the fuel and has a central bore 48 lying in the axis of the nozzle. Connected to the central bore 48 is the terminal cone 24 of the fuel-supply duct or passage 25 which is secured by the cap nut 27 with the intermediary of the washer 26.

Figures 3 and 4 illustrate slight modifications in the arrangement of the bores in the cylindrical guide member. In accordance with the form of construction shown in Figure 3, radial passages 28 which run into a passage 29, preferably located along the axis of the valve or needle, are provided directly below the valve seating surface. Preferably four bores are provided offset by 90° from each other. The passage 29 is followed below by a conical recess 30 which then runs into a cylindrical recess 31. The latter is extended by the conical recess 49 in the outer nozzle body 40. A disc-shaped recess 38 in the outer nozzle body permits of the opening of the nozzle valve or needle whose stroke is determined by the depth of the recess 38. The stroke of the nozzle valve or needle is indicated at 51.

In the form of construction according to Figure 4, radial passages 32 which run into a conical recess 34, advantageously through a central passage 33, are likewise provided below the valve surface. The annular gap or groove 35, provided in the vicinity of the upper edge of the cylindrical guide, serves with the obliquely downwardly directed passages 36 for relief. The space 35 and the passages 36 also have for object to enable the part of the fuel which squeezes through at the upper edge of the cylindrical end of the needle under the action of the injection pressure to be conducted to the main jet.

In the form of construction according to Figure 5, a throttling collar or flange 39, which allows only a slight fraction of the fuel to pass in the first part of the stroke of the nozzle valve or needle, is provided above the conical seating. Due to this measure, only a small fraction of the fuel is ejected into the combustion space during the period of the ignition delay (say 10° of crank angle), so that smooth running of the engines is attained.

The manner of operation of the nozzle in accordance with Figure 1 is as follows:

The liquid fuel flows through the duct or passage 22 and through the recesses 17 into the space 4 in front of the valve 10, 11, and the latter opens under the liquid pressure in accordance with the impulses of the injection pump. The fuel is thus firstly spread conically by the valve seating surface 10, is immediately thereafter brought together again, in the annular gap at 8, to form a hollow cylindrical jet and is atomised in extremely fine fashion during passage through this gap. The upper guide ensures a uniform width of gap and provides for the valve stem remaining precisely located even in the case of one-sided pressure action of the liquid flowing through the valve passage at 6, 8, and thus for the radial width of the passage gap at 6, 8 remaining precisely the same. In this fashion, a uniform injection formation or picture of the fuel jet issuing from the nozzle is also ensured. At the same time, due to the wide outflow opening 12 directly in front of the valve 10, the fuel liquid can arrive unobstructed, in large quantities, free from bubbles and uniformly distributed. Furthermore, the comparatively wide outlet opening prevents the valve stem from sticking or jamming at this point, and avoids caking of resinified oil particles or jamming of the stem due to stresses arising upon the screwing of the nozzle into the thread. The invention is naturally also applicable to mechanically controlled valves.

In the forms of construction in accordance with Figures 2 to 5, the fuel flowing in from above is finely divided in passing through the valve seating and the radially or conically disposed passages, is brought together shortly in the central collection passage and is then atomised into the combustion space as a conical or cylindrical veil.

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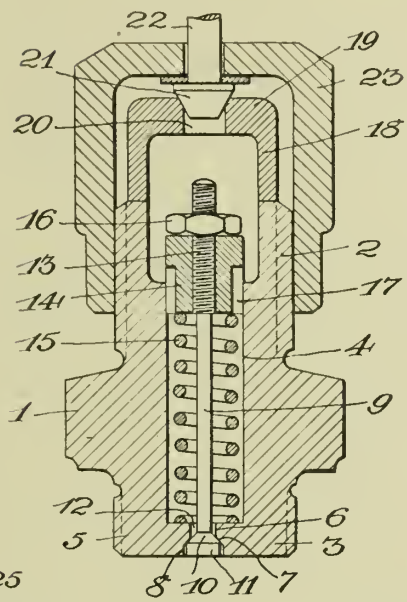

Fig. 1.

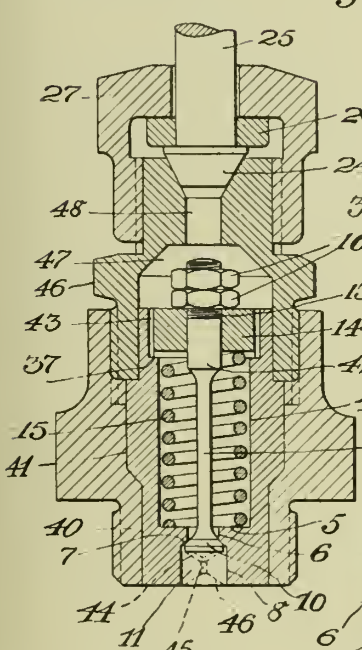

Fig. 2.

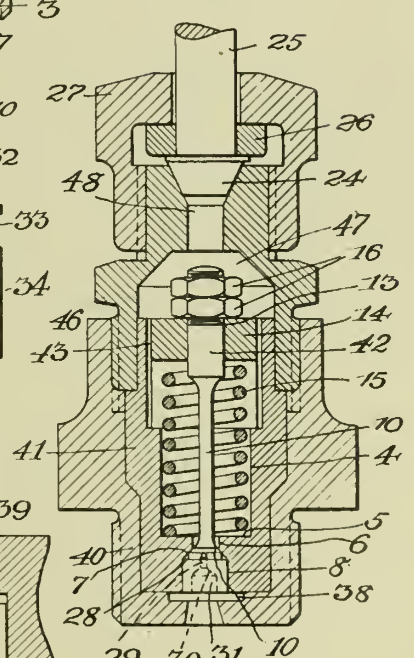

Fig. 3.

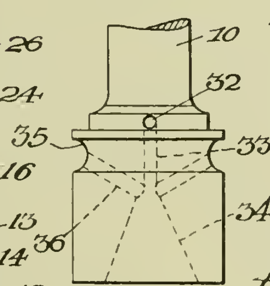

Fig. 4.

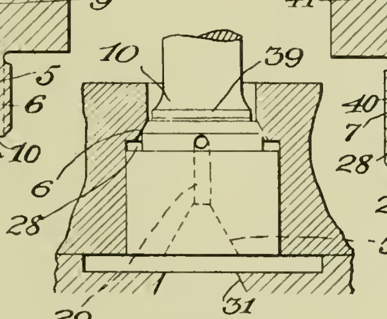

Fig. 5.

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ALIEN PROPERTY CUSTODIAN

METHODS OF FIXING TUBULAR RIVETS

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Application filed July 26, 1939

The present invention relates to methods of fixing tubular rivets, unions and like hollow elements and more particularly to a method in which a headed mandrel is drawn through the bore of the rivet to perform the upsetting operation.

An object of the present invention is to provide an improved method of riveting which ensures security of the riveted joint while at the same time using rivets which are easily manufactured and are not costly to produce.

According to the present invention a method of riveting consists in inserting through a hole in the parts to be riveted a tubular rivet having a head at one end, a cylindrical bore, a shank and at least one external collar on the shank, the outside diameter of the shank and collar being less than that of the hole, holding the rivet with the head juxtaposed to the parts to be riveted and drawing through the rivet from the tail end towards the head, a mandrel having a head of larger diameter than the bore of the rivet whereby initially to upset the tail end of the rivet and expand the collar into engagement with the part to be riveted and finally to pass completely through the rivet.

The present invention will be more fully described hereinafter with reference to the accompanying drawings which show, by way of example, the application of the method of riveting according to the present invention, to tubular rivets, unions and to the securing of tubes to plates.

In the drawings:

Figs. 1 to 3 are sectional views showing the application of the method of the present invention to rivets having various forms of head.

Figs. 4 and 5 are similar views showing methods of fixing unions to tubes and to plates respectively.

Figs. 6 to 9 are sectional views showing the method as applied to the use of various forms of tubular rivet for securing tubes to plates.

Referring to Fig. 1; a tubular rivet provided with a preformed head 8 and an external collar 9 on its cylindrical shank portion 7 is to be used for securing together two plates 1 and 2 having a hole 3 therein. The reference numeral 4 refers to the conical head of an upsetting mandrel, the stem 5 of which may be gripped in the jaws of a riveting machine to draw it in the direction of the arrow. 6 indicates the nose of the riveting machine which is pressed against the head 8 of the rivet.

The diameter of the head of the mandrel is greater than the internal diameter of the rivet and is preferably intermediate between the internal and external diameter thereof.

When the mandrel is drawn through the rivet, it first expands the collar 9, which grips the under side of the plate 2, all round the hole 3. The mandrel then expands the shank of the rivet to fill completely the free space between the walls of the hole 3 and the shank of the rivet.

When the mandrel has passed completely through the rivet, the plates are riveted tightly together.

The preformed head of the rivet may be of any convenient shape, for example chamfered as shown in Fig. 1.

Fig. 2 shows an alternative form of rivet in which the preformed head 8 of the rivet shown in Fig. 1 is replaced by an upper expansion collar 9^1. This symmetrical design of the rivet facilitates production, and enables the rivets to be mounted automatically on the mandrels of the riveting machines, since they can be threaded thereon either way up as either of the expansion collars 9, 9^1 can pass through the holes in the plates. In passing through the rivet, said mandrel first expands the lower collar 9, which grips the under side to the plate 2, then expands the shank 7, which completely fills the hole 3, and finally expands the upper collar 9^1 which grips the plate 1 and forms the head of the rivet.

Fig. 3 shows a rivet of the same type, the upper plate 1 being countersunk at 10, to receive the upper expansion collar 9^1 when the latter is expanded. With this form, no part of the rivet projects above the surface of the plate 1 after upsetting. Should it also be desirable for the rivet not to project below the plate 2, the latter may be similarly countersunk.

The application of this method of riveting to a union is shown in Fig. 4.

The union 12 has a screw-threaded portion which projects beyond the tube 13 to which it is to be secured, and has a cylindrical shank portion which enters the tube and is provided with two expansion collars 9 and 9^1 and a short conical section 9^2. The tube 13 is inserted in a reinforcing ring 14 provided with three annular recesses 15, 15^1 and 15^2 corresponding in position with the collars 9, 9^1 and 9^2 respectively.

The head 4 of the upsetting mandrel has a diameter greater than the internal diameter of the cylindrical shank of the union, and, in passing through the union expands, firstly, the collar 9 (which forces the tube into the recess 15), then the cylindrical portion and a second collar 9^1 (which forces the tube into the groove 15^1)

and the remaining cylindrical portion, and finally the conical section 9^2 which forces the tube 13 into the corresponding recess 15^2 in the ring 14.

The expansion collars and the corresponding recesses in the ring 14 may be of any desired number and shape. These unions may also be fixed without any exterior ring such as 14.

Fig. 5 shows a union 16 having an external expansion collar 9 and which is to be secured to a plate 1.

During the upsetting operation the union 16 is held in position by the nose 6 of the riveting machine. The mandrel 4, in passing through the union 16, first expands the collar 9 (which grips the under side of the plate 1), and then expands the cylindrical shank of the union to fill the hole in the plate 1.

When the mandrel has passed completely through, the shank 16 makes a perfectly tight joint with the plate 1.

This type of rivet having external expansion collars may be used to secure tubes to plates as indicated hereafter.

Fig. 6 shows an example of this method of fixing, 13 indicating the tube to be secured to a plate 1. A headed rivet, having a shank 7 with an external expansion collar 9 is inserted in the tube.

The head of the rivet is pressed against the plate 1 by the nose 6 of the fixing machine. In passing through the rivet, the mandrel, the head of which has a diameter greater than the internal diameter of the shank of the rivet, expands the collar 9, which deforms the tube and causes it to engage the lower surface of the plate 1.

The mandrel then expands the cylindrical shank 7 of the rivet, pressing the outer face of the tube against the wall of the hole in the plate 1.

Fig. 7 shows another example in which the expansion collar 9 of the rivet occupies a position within the thickness of the plate 1. The hole in which the tube 13 is to be secured is provided with an annular recess 15 on a level with the collar 9 of the rivet, so that, in passing through the rivet, the mandrel expands said collar 9 which forces out the tube to fill the free space in the recess 15. The tube 13 is more firmly secured than in the case of the preceding example.

Fig. 8 shows a further example in which the rivet is provided with two expansion collars 9 and 9^1 and with a short conical section 9^2.

In passing through the rivet, the mandrel expands the first collar 9, which distends the tube 13 against the under side of the plate 1. It next expands the cylindrical portion, and then the second collar 9^1, which forces the tube into an annular recess 15 provided in the hole of the plate 1. Continuing its stroke, the mandrel expands the cylindrical portion, and then the conical section 9^2, which forces the end of the tube into a corresponding recess 15^1 provided in the upper face of the plate. The tube is thus secured very firmly to the plate.

The bore of the rivet which is substantially uniform over the greater part of the length of the shank portion may be relieved as indicated at the upper end to prevent any metal drawn up by the passage of the mandrel from protruding beyond the head of the rivet. The tail end may also be enlarged conically to facilitate the upsetting thereof by the mandrel.

Fig. 9 shows an example in which the rivet 7 employed to secure the tube 13 is symmetrical and headless being provided with two expansion collars 9 and 9^1. The manner in which the tube is secured will be easily understood from the description of the preceding examples.

To give increased strength a third collar might be arranged between the collars 9 and 9^1 to force the tube into an annular recess provided about midway of the thickness of the end plate 1. In the embodiment shown, the upper end of the hole is chamfered as indicated at 15 to receive the upper expansion collar 9^1.

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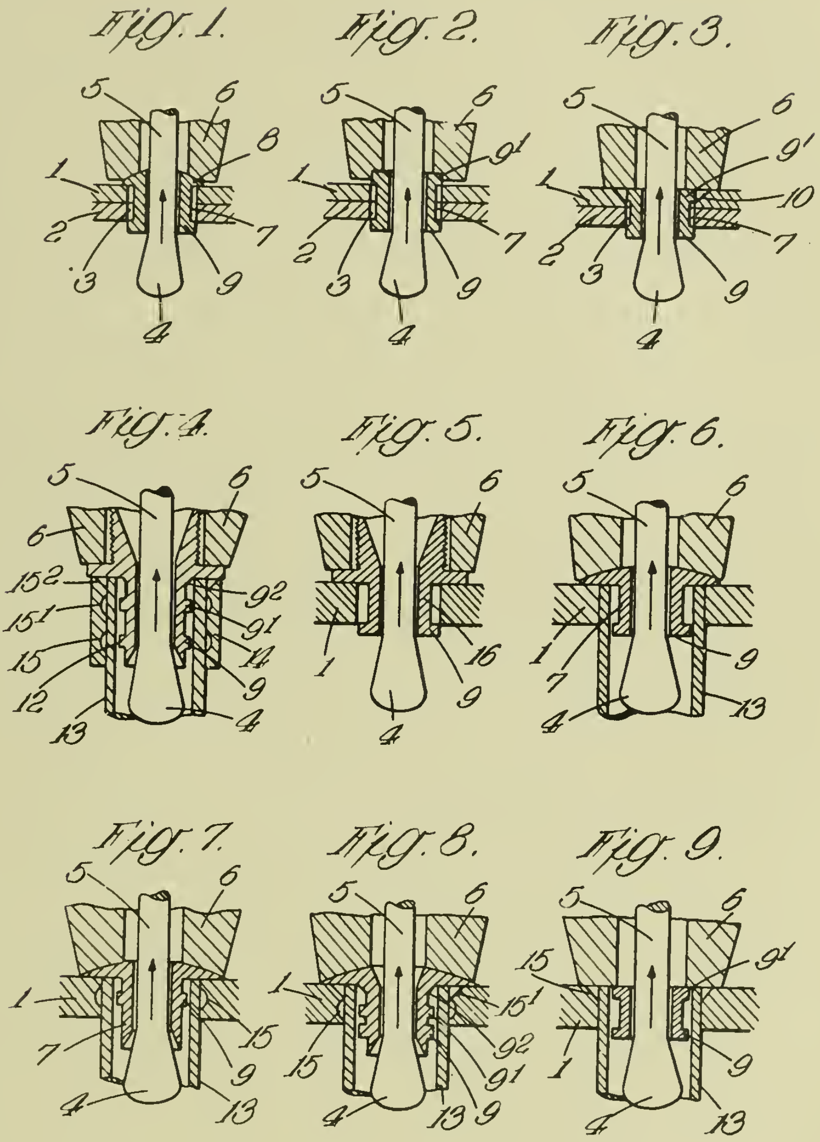

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Published June 8, 1943

Serial No. 297,760

ALIEN PROPERTY CUSTODIAN

GYROSCOPIC INSTRUMENT

Heinrich Künzer, Kiel, Germany; vested in the Alien Property Custodian

Application filed October 3, 1939

My invention relates to a gyroscopic instrument of the type in which a device controlled by one or more gravity-responsive elements is adapted to exert a torque on the gyroscope causing the same to perform a precessional motion whereby the gyroscope is brought to a predetermined position.

Gyroscopic instruments of this type are widely used in aviation for the purpose of navigation.

More particularly, my invention relates to a device of this kind known as the "artificial horizon." In this instrument, the gyroscope is mounted in neutral equilibrium on horizontal axes and its spinning axis is maintained in the direction of gravity by the application of torques which are rendered effective about the horizontal axes of suspension and are controlled by gravity-responsive elements such as pendulums, whereby the gyroscope is directly restored to the vertical without oscillation if it should temporarily depart therefrom. As the gyroscope responds to such torques very slowly, it gives an indication of the horizon by an integration of the varying directions of the apparent gravity.

However, my invention is equally applicable to a course indicator comprising a gyroscope mounted in neutral equilibrium and provided with means holding its spinning axis in horizontal position. These means exert a torque on the gyroscope whenever the same departs from the horizontal position causing the gyroscope to perform a precessional movement whereby it is returned to the horizontal position.

The primary object of my invention is to provide an instrument of the character explained which is very accurate and reliable in operation, simple in its design and free from electrical contacts or amplifying devices.

Another object is the provision of gravity-responsive means which are adapted to control an electric current and are extremely sensitive.

These and other objects are attained by the use, as the gravity-responsive element, of a level which controls an electric current operating the torque-producing device. The level constitutes a continuously variable electrical resistance which is free from any contacts or any moving elements subject to wear. The liquid contained in the level controls the electric current energizing the torque producer and represents itself the gravity-responsive element. Preferably, the liquid constitutes the variable resistance which will continuously vary the energization of the torque producer in accordance with the requirements. This has the advantage over pendulum-controlled contacts that radio disturbances are avoided which are liable to be occasioned by contacts.

I may use a single level for the simultaneous control of the two torque producers of an artificial horizon thus obtaining an instrument of unexcelled simplicity.

Further objects and features of my invention will appear from the description of some preferred embodiments following hereinafter. The features of novelty will be pointed out in the claims.

In the drawings,

Fig. 1 is a vertical section through my improved current-controlling level;

Fig. 2 shows a vertical section through a modification;

Fig. 3 is a diagrammatic perspective view of a direction indicator provided with the level of Fig. 1;

Fig. 4 is a diagrammatic perspective view of an artificial horizon provided with two current-controlling levels;

Fig. 5 is a similar view of a modified artificial horizon provided with a single level;

Fig. 6 illustrates a vertical section through the level shown in Fig. 5;

Fig. 7 is a plan view of Fig. 6;

Fig. 8 is a perspective view of the instrument diagrammatically shown in Fig. 5, and

Fig. 9 shows the circuit arrangement of the instrument illustrated in Figs. 5 and 8.

The instrument illustrated in Fig. 3 may be set to indicate a predetermined azimuth and will then maintain the setting irrespective of accelerations or other influences to which the instrument may be subjected. Therefore, it may be used on an aircraft to indicate a predetermined direction while the aircraft performs complicated manoeuvers. It comprises a gyroscope having a horizontal spinning axis which is supported by a carrier in form of a housing 13 and is driven in a known manner, for instance, by an electrical induction motor. The housing 13 is provided with trunnions 25 having a common horizontal axis extending at right angles to that of the gyroscope. The trunnions 25 are journalled within a gimbal ring 12 provided with vertical trunnions 26 journalled in bearings 27 attached to the frame of the instrument. One of the trunnions 26 carries an indicator which may be set by the pilot to a predetermined position before the aircraft enters into complicated manoeuvers and which will then retain the set direction. The axis of the trunnions 25 intersects the axis of the trunnions 26 at the common center of gravity of the carrier

13 and of the gyroscope whereby the latter is suspended in neutral equilibrium.

As the gyroscope is subject to couples produced by friction of the trunnions 25 and 26 in their bearings and by the earth's rotation, it tends to gradually depart from the horizontal position and might eventually arrive in a vertical position in which it could no longer stabilize the frame 12. In order to prevent that, means are provided exerting a torque on the frame 12 about the axis of the trunions 26 whenever the spinning axis of the gyroscope tends to depart from horizontal position. This torque causes the gyroscope to perform a slow precessional movement about the axis of the trunnions 25 whereby it returns to horizontal position.

In known instruments of this kind the torque is produced by the reaction of air jets. In cold weather, however, ice may form within the air conduits and may plug the same. Therefore, it is an object of my invention to provide improved control means for the torque producers which are not sensitive to cold weather.

To this end, I have mounted a level 1 on top of the gyroscope carrier 13. This level acts as a variable electrical resistance controlling the energization of an electrical torque producer 14 interposed between the lower bearing 27 and the trunnion 26. The torque producer may be formed by a reversible induction motor operated by alternating current, the stator thereof being attached to the frame 12 and the rotor being fixed to the trunnion 26.

In Fig. 1 I have shown a vertical section through the level 1. It comprises a sealed housing 28 of insulating material having a substantially cylindrical shape which is suitably attached on top of the gyroscope carrier 13 and includes a conductive liquid 2. However, a bubble 6 is left which may consist of air, gas or some other insulating medium, such as oil. The bottom of the housing 28 is provided with a bore through which an electrode 3 extends projecting a certain distance into the liquid 2. In the cover of the housing 28 two electrodes 4 and 5 are inserted at a distance which is less than the diameter of the bubble 6. The electrodes 4 and 5 have interior heads 29 which are partly covered by the bubble 6 when the level is in normal position. Preferably, the liquid 2 acts as a variable electrical resistance. For this purpose, it may be formed by a salt-containing solution of limited conductivity. In order to lower the freezing point, alcohol may be added thereto.

I have mentioned above that the torque producer is preferably formed by an induction motor energized by alternating current and provided with two windings counteracting one another. The relative energization of these two windings determines the direction and the rate of the torque produced. One terminal of each winding is connected with the electrode 4, or 5 respectively, and the other terminal is connected with one pole of the source of current, while the other pole thereof is connected with the electrode 3.

The operation is as follows: As long as the air bubble assumes the central position shown in Fig. 1, the paths of current extending from the electrode 3 through the resistive liquid 2 to the electrodes 4 and 5 have the same length and the same resistance. Consequently, the two counteracting windings of the motor 14 are equally energized and balance one another so that the motor produces no torque on the gimbal ring 2.

As soon, however, as the direction of the apparent gravity has a component acting in the direction a—a, which occurs upon departure of the spinning axis of the gyroscope from the horizontal plane, the air bubble 6 moves in the opposite direction. Assuming that it moves towards the right with reference to Fig. 1, the area of contact between the electrode 4 and the liquid will increase while the area of contact between the electrode 5 and the liquid decreases. This has the effect of shortening the path of current between the electrodes 3 and 4 while the path between the electrodes 3 and 5 becomes longer. Hence, the two counteracting windings will no longer balance each other but the energization of one winding will overcome that of the other and will produce a torque on the gimbal ring 12 which is substantially in proportion to the departure of the bubble 6 from its central position. The torque thus produced causes the gyroscope to perform a precessional motion about the axis of the trunnions 25. This precessional motion returns the spinning axis of the gyroscope to the horizontal plane at a very slow speed.

The longitudinal profile of the housing 28 is preferably straight near the center and curved near the ends thereof. Therefore, the bubble 6 will depart from its central position an amount which, with increasing inclination of the level, increases less than in proportion therewith.

The invention is capable of numerous modifications. In Fig. 2 I have illustrated an embodiment in which the electrode 5 has been omitted. In this embodiment, one of the two opposed windings of the motor 14 is arranged in series with the electrode 4, whereas the other winding is permanently energized. The two windings, however, are so differently proportioned that the maximum energization of the level-controlled winding is substantially more powerful than that of the other winding.

In the normal position illustrated in Fig. 2 the bubble 6 covers half of the surface of the electrode 4. Under these circumstances, the level-controlled winding is so energized as to balance the constant winding thus producing no torque. A torque in one or the other direction will be produced, however, when the air bubble 6 departs in one or the other direction from the center.

The cover of the housing 28 may be so profiled that the departure of the bubble 6 from the center will be in proportion to the inclination of the level to the direction of the apparent gravity. In this event, the level will be less sensitive which may be desirable under certain circumstances.

While in the embodiments described hereinabove the liquid of the level constitutes the variable resistance, I may modify the arrangement by making the electrode heads 29 of an electrical resistance material while a liquid of high conductivity is chosen. The heads 29 may consist of a core of copper, for instance, covered by a lining of a suitable resistance material, such as a mixture of rubber and finely ground graphite. The liquid may be mercury. The larger the area of the head 29 is that is covered by the mercury, the more powerful will be the current flowing through the electrode.

In Fig. 4 I have shown an artificial horizon to which my invention has been applied. The gyroscope carrier 15 is formed by a housing enclosing a gyroscope having a vertical axis. The instrument serves the purpose of indicating a fixed horizontal plane with respect to the earth's

surface during manoeuvers in which the direction of the apparent gravity departs from the true vertical. Horizontal trunnions 30 of the carrier 15 are journalled in a horizontal gimbal ring 16 which in its turn, is provided with trunnions 31 supported in bearings 32 attached to the frame of the instrument, the axis of the trunnions 31 extending at right angles to that of the trunnions 30 and intersecting the same at the common center of gravity of the gyroscope and of its carrier 15. Hence, the gyroscope is mounted in neutral equilibrium.

In the absence of the auxiliary equipment to be described hereinafter, the gyroscope would slowly depart from vertical position under effect of the friction of the trunnions 30 and 31 in their bearings and under effect of the earth's rotation. In order to prevent such departure, suitable torques are produced on the trunnions 30 and 31 causing the gyroscope to perform precessional motions returning it to vertical position. To this end, a torque producer 17 is interposed between the trunnion 31 and the gimbal ring 17 and a second torque producer 18 is inserted between the trunnion 30 and the gimbal ring 16. In other words, the gimbal ring which constitutes the means for mounting the gyroscope in neutral equilibrium is connected with the stator of the torque producer 18 and with the rotor of the torque producer 17, while the stator of the latter is attached to the bearing 32; the rotor of the torque producer 18, however, is attached to the trunnion 30. In known instruments of this kind the torque producers were controlled by pendulums actuating contacts. In lieu of such pendulums which are subject to wear and are liable to produce radio disturbances, I have provided two levels 19 and 20, the level 19 being mounted on the gimbal ring 16 so as to respond to oscillations theerof about the trunnions 31, while the other level 21 is mounted on the gyroscope carrier 15 so as to respond to rotations thereof about the trunnions 30. The level 19 controls the torque producer 18 and the level 20 controls the torque producer 17 in the manner described hereinabove with reference to Figs. 1 and 2.

A considerable simplification of the instrument results from the provision of a single level for the control of the two torque producers. This is illustrated in Figs. 5 to 7. The level 33 mounted on top of the gyroscope carrier 15 is formed by a capsule having a round cover provided with two opposed pairs of electrodes 21, 22 and 23. 24. These electrodes control the two torque producers 17 and 18.

In Fig. 6 I have shown a vertical section through the level 33. It comprises a circular cup 35 of sheet metal provided with a metal cover 36. Preferably, the cover 36 has a circumferential groove engaging over the rim of the cup 35 and containing a suitable sealing material 37. The outer wall of this groove is bent inwardly as shown at 38 to engage over a flange 39 of the cup 35. In this manner, the cup may be effectively sealed in a very simple manner. The four electrodes 21, 22, 23 and 24 are inserted in suitable openings of the cover 36 and are suitably attached therein. To this end, each electrode may be provided with a reduced upper pin 40 which is riveted in place as shown at 41. Each electrode is surrounded by a suitable bushing 42 of insulating material.

The cover 36 is provided with a central opening 43 through which the level may be filled with the liquid 2. The opening 43 is then closed by a threaded plug 44 and a suitable washer. If desired, the level shown in Fig. 6 could be so modified that the continuously variable resistances would be formed by the electrodes rather than by the liquid, as above described with reference to Figs. 1 and 2.

In Fig. 9 I have shown the electrical circuit arrangement of the instrument illustrated in Fig. 5. The gyroscope is driven by an induction motor 45 connected to the three phases R, S and T of a source of three-phase alternating current of a frequency of 300–500 cycles per second. A current of this kind will not attack the liquid and the electrodes by electrolysis. Each of the two torque producers 17 and 18 is constituted by a reversible induction motor equipped with three windings 46, 47 and 48. The two windings 47 and 48 counteract and balance one another when they are equally energized. In this event, no torques are produced. The two windings 46 are arranged in series and are connected between the phase T and the central tap 49 of an inductance coil 50 inserted between the phases R and S. In this way, the windings 46 are constantly energized. The counteracting windings 47 and 48 have their joined terminals connected through wires 51 and through an adjustable resistance 52 with the phase R. The other terminals of the windings 47 and 48, however, are connected with the electrodes 21, 22, 23 and 24. The housing 35, 36 of the level 33 is connected through a line 53 with the phase S which may be grounded. The resistance offered by the liquid 2 to the passage of current between the housing and the individual electrodes 21, 22, 23 and 24 will vary depending on the position of the air bubble 6, Fig. 6. When this air bubble departs from its central position shown in Fig. 6, it will so unbalance the energization of the windings 47 and 48 as to cause the torque to be produced that is required to control the gyroscope axis in the desired manner. The rate of the torque may be controlled by the adjustable resistance 52. It will be readily understood that in this manner the two torque producers 17 and 18 may be controlled simultaneously and independently by the single level. Thus, when the bubble should move from its central position towards the electrode 21 and away from the electrode 24 while keeping equal distances from the electrodes 22 and 23, it will start the motor 17 only without, however, starting the motor 18 at the same time. If the bubble, however, should approach the electrodes 21 and 22 at the same time while receding from the electrodes 23 and 24, the two torque producers 17 and 18 would be unbalanced simultaneously so as to produce torques.

While Fig. 5 is a very diagrammatic illustration of the instrument only, I have shown a practical embodiment thereof in Fig. 8. The frame 53 of the instrument carries the bearings 32 for the gimbal ring 16 which, in its turn, carries the bearings for the trunnions 30 of the gyroscope carrier 15. The torque producers or motors 17 and 18 are arranged as above described. It is to be understood, of course, that in normal operation the gyroscope carrier 15 is so positioned as to hold the spinning axis of the gyroscope in vertical position. In Fig. 8 it is shown in abnormal position for a better illustration of the torque producer 18.

HEINRICH KÜNZER.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

H. KÜNZER
GYROSCOPIC INSTRUMENT
Filed Oct. 3, 1939

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297,760
5 Sheets-Sheet 1

Fig. 1

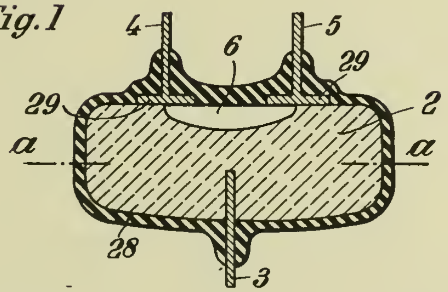

Fig. 2

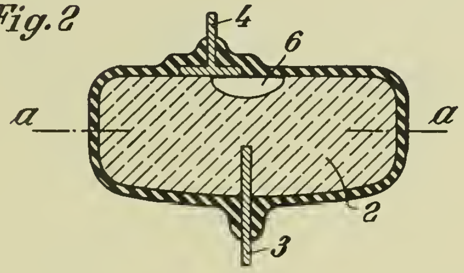

Fig. 3

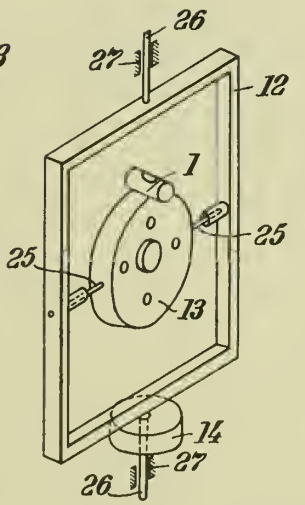

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Fig. 4

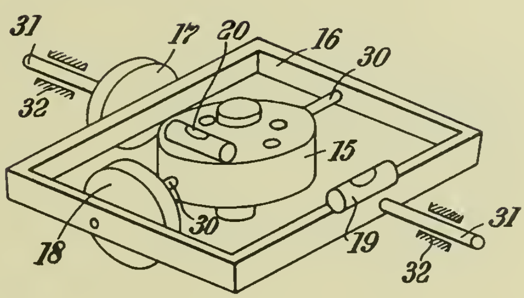

Fig. 5

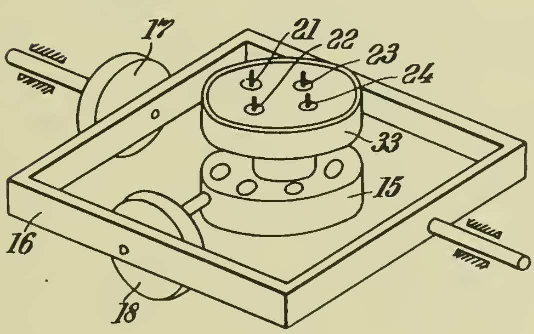

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Fig. 6

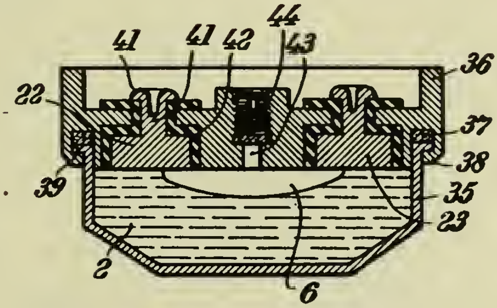
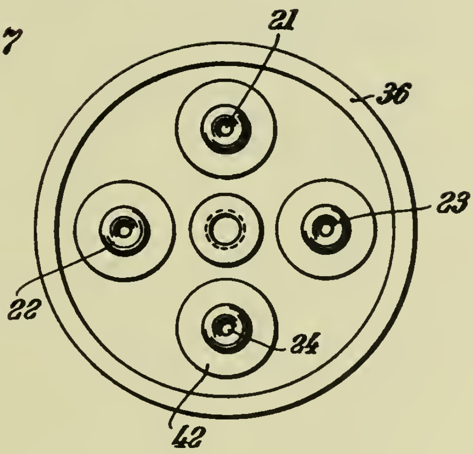


Fig. 7



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PUBLISHED	**H. KÜNZER**	**Serial No.**
JUNE 8, 1943.	GYROSCOPIC INSTRUMENT	**297,760**
BY A. P. C.	Filed Oct. 3, 1939	5 Sheets-Sheet 4

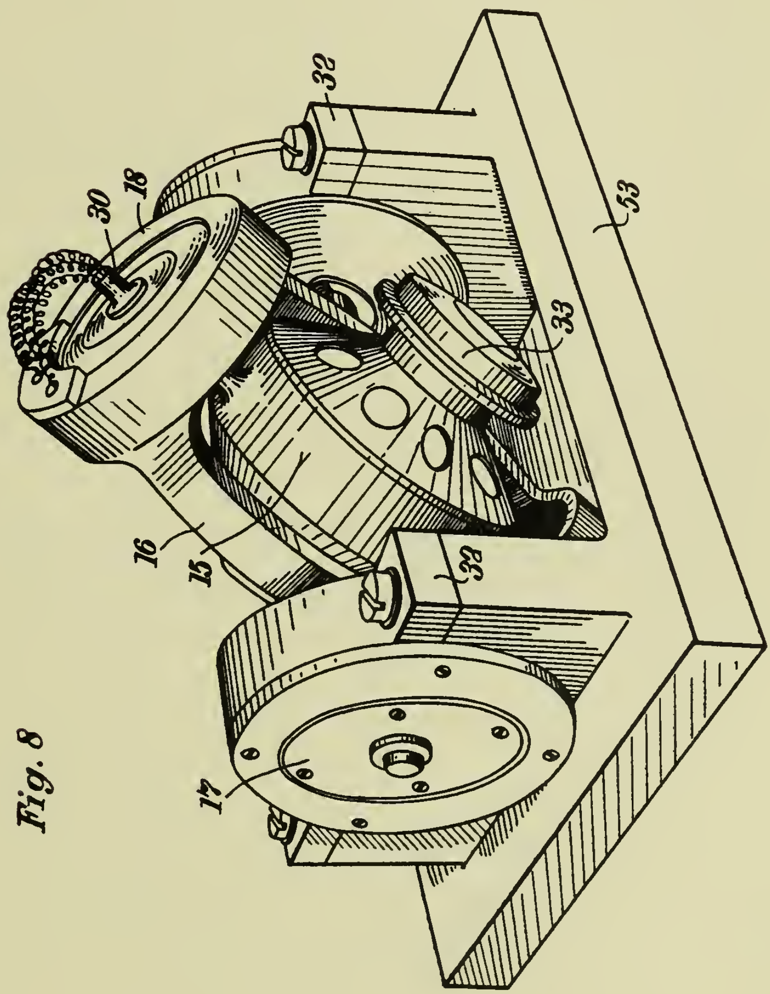

Fig. 8

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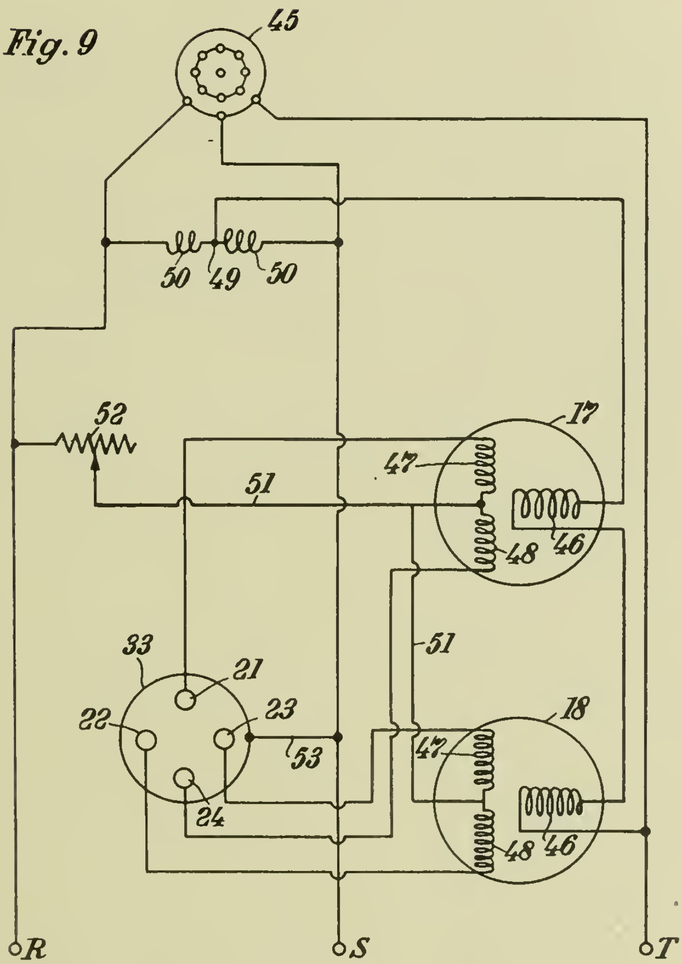
Fig. 9



Inventor:
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Published June 8, 1943

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR OBTAINING DETERGING, WETTING, FOAMING, METALLIC SALT DISPERSING AND EMULSIFYING AGENTS AND THE AGENTS OBTAINED BY THIS PROCESS

Jean Paul Amédée Vallernaud, Valence-S/Rhone, France; vested in the Alien Property Custodian

No Drawing. Application filed December 12, 1939

The present invention relates to novel deterging, wetting, foaming, metallic salt dispersing agents (more particularly for the dispersion of earth-alkaline salts) and emulsifying agents and to the process for making the same.

For obtaining agents of this kind it has already been suggested to treat with sulphuric acid the product of the condensation of certain fatty acids with monoethanolamine; but the obtained products lacked more or less of efficiency with respect to one or more of the deterging, wetting, foaming, dispersing or emulsifying properties. Furthermore, it was impossible directly to obtain products in a finely divided pulverulent form which did no longer agglomerate.

On the other hand, the use of mono-substituted amines sometimes led to condensation products containing more than one amine molecule and thus one or more of the above mentioned properties were more or less suppressed.

According to the present invention it has been devised to start from murumuru butter or from fatty acids derived from partially saponified murumuru butter and to condense them with poly-substituted amines, the so obtained condensation product being then treated with an acid capable of yielding a sulphonated or phosphonated derivative or a sulphuric or phosphoric ether.

As poly-substituted amines, methyl-ethylamine, methyl-propylamine, methyl-butylamine, methyl or ethyl-ethanolamine, propanolamine, methyl or ethyl - propanolamine, dodecyl - ethanolamine, oleyl-ethanolamine, ricin-ethanolamine and the like may be used.

As acid, ordinary mono-hydrated or anhydride loaden sulphuric acid, chloro-sulphonic acid, phosphoric anhydride acid chlorides or a mixture of the said various bodies and the like may be used.

As starting product, mixtures of murumuru butter with lauric acid and vegetable oil hydrogenation products condensed either with the above mentioned amines or with the products resulting from the condensation of ammonia or of an amine with the terpenic hydrocarbons and alcohols and the ethers of the latter may be used.

The sulphonation and phosphonation are performed with or without the presence of bodies such as sodium tungstate, ammonium vanadate, chloraldehyde and the like.

The products obtained have properties which are very marked as to the wetting of vegetable and animal textile fibers and of leather and hides as well as of furs; they dissolve and disperse lime soaps and other metallic soaps and yield a copious and persistent foam with impure waters; owing to their detergent properties they are well suited as industrial and domestic cleaning agents or as auxiliary agents for bleaching or dyeing agents; they are also good emulsifying agents. They are obtained directly without any physical or mechanical intervention in the form of a very fine powder of low density and which does not agglomerate.

As a non limitative example the following will be given: to 200 kilogs. of murumuru butter 70 kilogs. of methyl monoethanolamine are added and the whole is heated during two hours at 170° C. while removing the condensation water. A solid product is obtained, 100 kilogs. of which are treated with 80 kilogs. of oleum at 20% while stirring until a perfect solubility in cold water is obtained, in the presence of 10 grams of metavanadate of ammonia. The obtained sulphonate is added with sodium carbonate until neutral and it directly yields the soda salt in the form of a very fine and very dry powder.

JEAN PAUL AMÉDÉE VALLERNAUD.

Published June 8, 1943

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ALIEN PROPERTY CUSTODIAN

ARMED ROTATING TURRETS FOR AIRCRAFT

Ettore Lanciani, Milan, Italy; vested in the Alien Property Custodian

Application filed December 16, 1939

The present invention refers to important improvements in the armed rotating turrets for aircraft.

An important problem referring to the achievement of armed rotating turrets for aircraft is the problem of the weapon's suspension. Another fundamental problem concerns the means for rotating the turret, both problems completing each other.

According to the invention the system of the weapons mounting comprises: a bolster substantially arranged on a diameter of the annular rotating structure, the weapon itself being mounted on a drum, which, besides allowing the training of the weapon in the vertical sector, secures a very good ammunition feed, because the weapon swings around an axis passing through the geometric center of the feeding aperture.

Another feature of the invention consists in this, that the outside fixed counter-ring associated with the inner moving ring is provided with rolling means corresponding to properly shaped surfaces in the inner ring, so as to reduce as much as possible the overall thickness of the two rings width.

According to the invention the rotation of the turret and of the weapon or weapons mounted in it, is operated by means of a hand-wheel carried on a swinging support, said hand-wheel being connected by means of a geared transmission to a rack or anything similar.

Preferably a single controlling means is provided for operating both the brandishing of the weapon and the rotation of the turret. The above stated feature and other more, will be more particularly specified in relation to the attached drawing, given, by all means, only as an example declared limiting in no way the range of the invention.

Fig. 1 shows the turret in a perspective view, partially stripped of its shroud to show the main parts concerning the invention;

Fig. 2 is a perspective projection of a part of the annular structure;

Fig. 3 is a partial perspective view of the diametral bolster carrying the drum;

Fig. 4 shows the weapons mounting on a larger scale and in side-elevation;

Fig. 5 is a cross-section, on a larger scale, along line 5—5 of Fig. 4.

Referring to Fig. 1, the outer fixed ring is shown in 1, and in 2 the inner rotating ring coupled to the latter. 3 is the diametral bolster carrying weapon 4 through a drum 5, in a manner which will be disclosed further on. 6 is a member for balancing the aerodynamic thrust as per another patent of the same authors.

Fig. 2 shows the details of the annular structure: the fixed outer-ring 1 carries on its upper edge 7, at usual distances, a number of rollers 8, pivoted in 9, against which runs the zone 10, of the movable ring 2. Another series of rollers 11, is pivoted in 12 to the central part 13 of the fixed ring, said rollers being mounted at right angles to the first rollers so that the moving ring 2 may come to bear rotatably on said rollers 11, by means of the projection 14. This secures a very good mounting, allowing the free motion of the inside ring. This latter ring carries the weapon's mounting 3, which provides the seat 15 for drum 5, solid with the weapon. Said drum (compare Figs. 4 and 5) is mounted on seat 15 by means of ball-races 16, whose outer rings 17 are fixed by means of screws 18 to the weapon's mounting or bolster 3. One end of said drum has an annular cover 19, to which is secured the feeding device 20 for the weapon, the feeding being achieved along the axis of the drum.

The other end has a cover 21, provided with an aperture 22 for the discharge. On cover 19 is bolted a gear-ring 23, meshing with toothed sector 24, operating the balancing member 6 in synchronism with the movements of weapon 4. 25 is an electric-detent according to another patent of same date of the authors.

Drum 5 carried webs 26 for swinging the brandishing system.

The details in construction and of application may vary materially without exceeding the limits of the invention.

ETTORE LANCIANI.

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JUNE 8, 1943.
BY A. P. C.

E. LANCIANI
ARMED ROTATING TURRETS FOR AIRCRAFT
Filed Dec. 16, 1939

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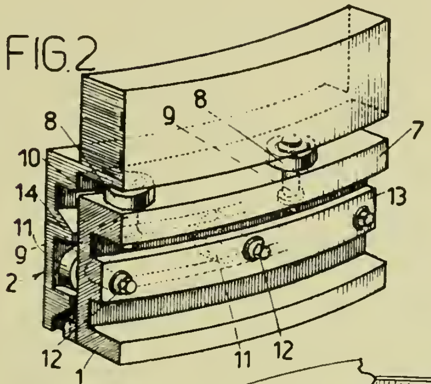

FIG. 2

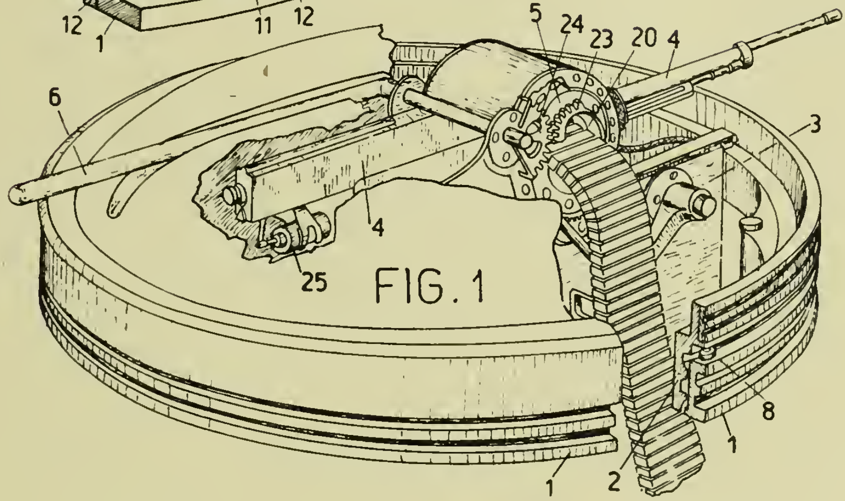

FIG. 1

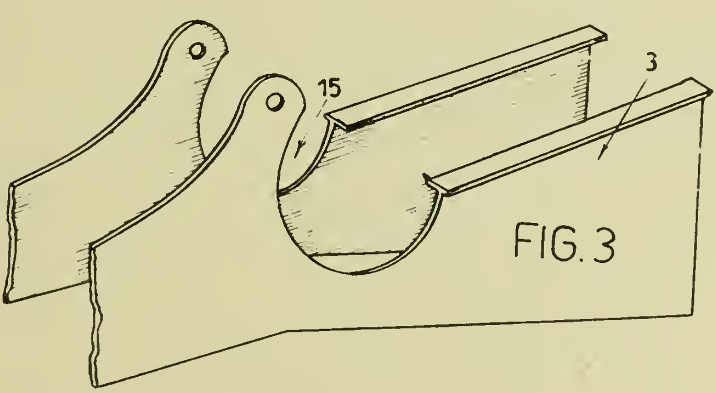

FIG. 3

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JUNE 8, 1943.
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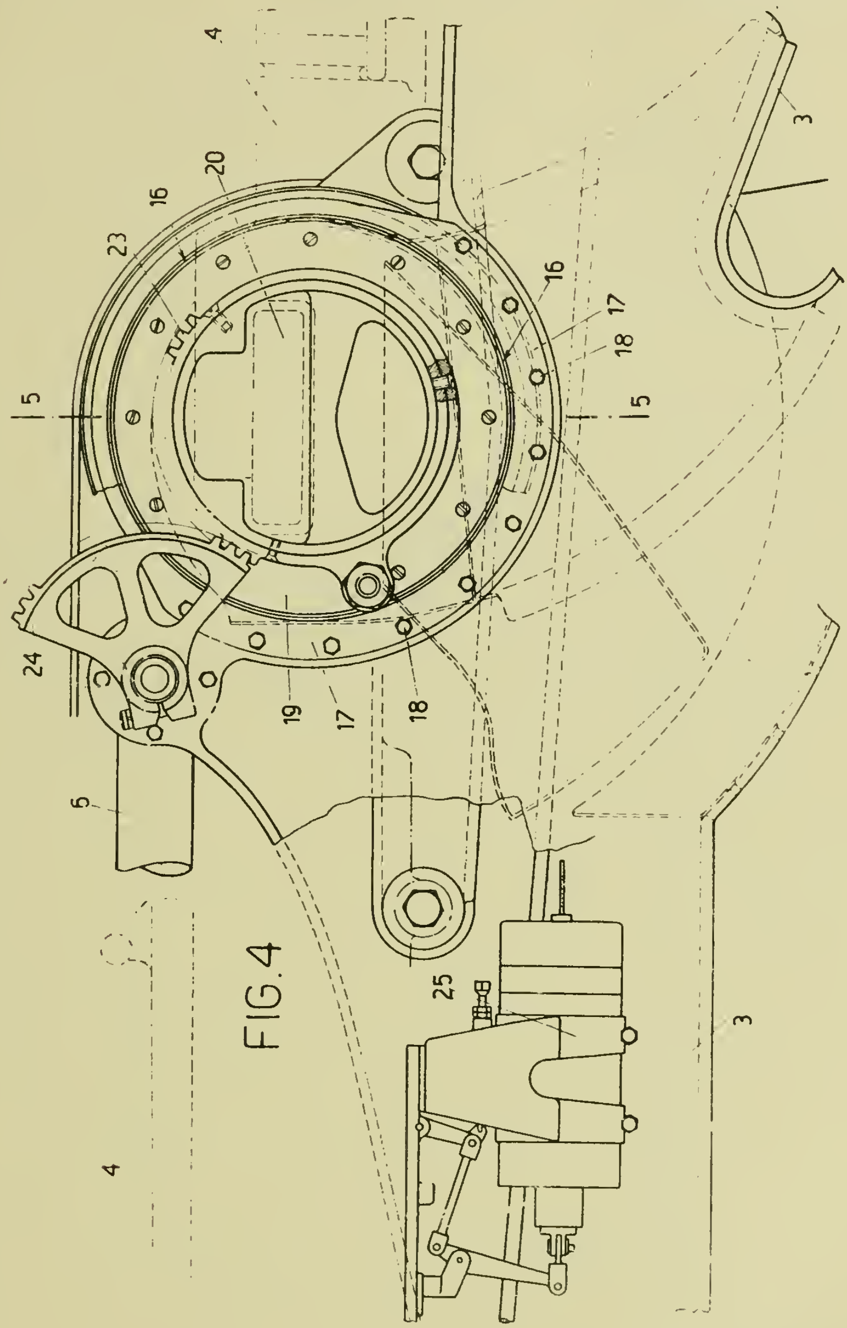

FIG. 4

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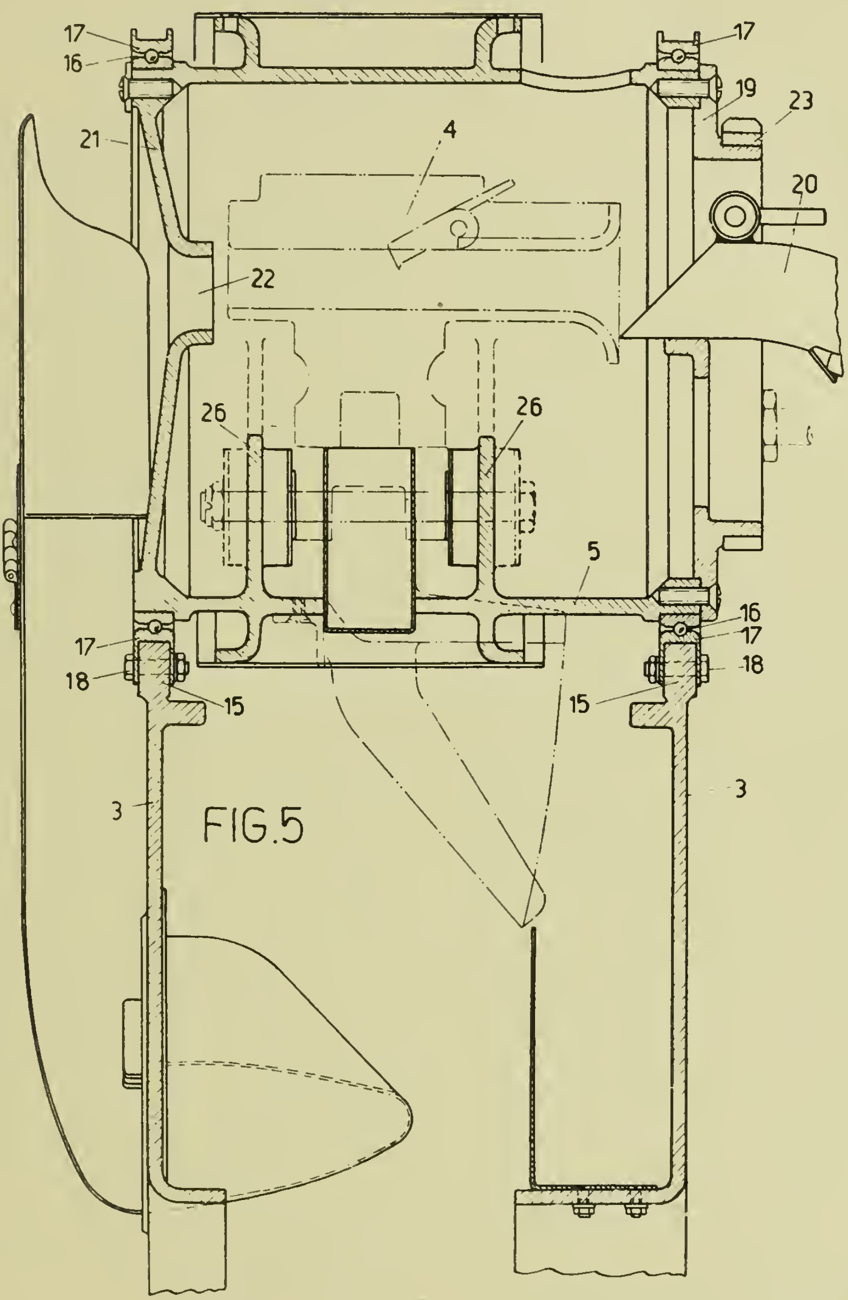

FIG.5

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ALIEN PROPERTY CUSTODIAN

CARBURATION DEVICES FOR INTERNAL COMBUSTION ENGINES

Marcel, Louis Mennesson, Neuilly - sur - Seine, France; vested in the Alien Property Custodian

Application filed January 9, 1940

This invention relates to carburation devices for internal combustion engines and more particularly to such devices comprising a carburettor and an enrichment and pick-up means, which latter is adapted to come into action automatically as a function of the suction prevailing in the intake pipe, more especially downstream of the throttle valve for the introduction of additional fuel into the said pipe during the pick-up period and the increase of the proportion of fuel when the pressure prevailing in the pipe exceeds a certain value, and has for its principal object so to make such devices that their operation is rendered more rational and, in a general manner, that they respond, better then hitherto, to the various desiderata of practice.

In accordance with the main feature of the invention, a permanent and calibrated communication is established between the source of fuel supply for the enrichment and pick-up means and the conduit by which this fuel is delivered to the intake pipe of the engine.

As a further feature the invention consists in so constituting the enrichment and pick-up means that the delivery valve (which previously has been proposed to be utilised therewith) can be omitted, by providing in the delivery conduit of these means a chamber which is located, by preference, below the constant level of the carburettor and which is made to communicate with the said means by at least one calibrated orifice.

As a still further feature the invention consists in making the delivery conduit of the enrichment and pick-up means open into the principal nozzle system so that the impulse given to the supplementary fuel at the time of the pick-up tends to increase the delivery from the calibrated device of the principal nozzle.

According to another feature, the invention consists in making the delivery conduit of the enrichment and pick-up means communicate with the principal nozzle system so that the additional fuel can also be introduced by the conduit termed "slow-running" into the intake pipe of the engine.

Yet another feature of the invention consists in disposing in the walls of the body of the carburettor, upstream of the throttle, grooves adapted to prevent the flow of the fuel along the walls of the said body towards the intake pipe of the engine.

In order that the invention may be better understood, it will now be described with reference to the accompanying drawings, which are given by way of example and in which:

Fig. 1 shows, in diagrammatic vertical section, a carburettor provided with an enrichment and pick-up device opening by a distinct orifice into the venturi of the carburettor, this device being constructed according to the invention.

Fig. 2 shows, similarly, a similar device but which is so arranged, according to the invention, that its delivery valve can be omitted.

Fig. 3 shows, similarly, a similar device but which opens into the principal nozzle system of the carburettor.

Fig. 4 shows, similarly, a modification of the device shown in Fig. 3.

According to the drawings, the carburettor proper is constituted in any suitable manner and for example as shown diagrammatically in Fig. 1, by a body 1, a regulating or throttle valve 2, a principal spraying well 3 which discharges into the venturi by apertures 4. Into this well there dips axially a perforated tube 5, terminated by a calibrated orifice 6. In this well there is also provided a calibrated orifice 7 which limits the delivery of fuel flowing towards the principal nozzle system. This calibrated orifice 7 communicates by a conduit 8 with the constant level chamber or any other feeding device adapted to replace this constant level (none of these devices, which are well known, has, however, been shown on the drawings). The conduit 8 also feeds a chamber 9 separated from a chamber 10 by a diaphragm 11. This diaphragm is subjected to two contrary influences, that of a spring 12 which tends to displace it towards the left of each of the Figs. 1 to 4 and that of the suction prevailing downstream of the regulating valve 2 and which acts in the chamber 10 through the conduit 13 by having a tendency to displace the diaphragm 11 towards the right.

To this diaphragm 11, which can be simple or multiple, is connected a valve 14 which rests on its seating when the diaphragm is drawn towards the right. This valve interrupts the communication between the chamber 9 and a delivery conduit 20 for fuel, this conduit serving as the housing for a ball valve 17 and communicating by the conduit 18 and the calibrated orifice 19, with the venturi of the carburettor. In the suction conduit is located a ball 15 and a stop 16 for example a pin, adapted to limit the movement of this ball.

The chamber 9 and the delivery conduit 20 communicate directly and permanently by a calibrated orifice 21.

The operation of the device thus constituted is the following. When the suction falls below a certain value for which the feed of the engine requires a desired enrichment, either for the pick-up period or for running at heavy loads, the diaphragm 11 is displaced towards the left, the action of the spring 12 then becoming preponderant over the action of the suction. When the diaphragm is displaced, the quantity of fuel contained in the chamber 9 is entirely delivered to the calibrated orifice 19. When its position is stabilised towards the left of Fig. 1, the valve

14 permits the direct passage, by the raising of the two balls 15 and 17, of the fuel from the conduit 8 up to the venturi of the carburettor. This supplementary feeding is assured by the suction which exists in the venturi of the carburettor opposite the orifice 19. The enrichment and pick-up delivery is then determined by the dimension of the calibrated orifice 19 and it is found that in order to assure a good operation during these enrichment and pick-up periods, the section of this orifice 19 must be relatively large.

In consequence, the volume of fuel, delivered at heavy loads of the engine, is determined by the section of the calibrated orifices 7 and 19. When the load is reduced, which necessitates a partial closing of the regulating valve 2, the action of the suction becomes preponderant over that of the spring 12, the diaphragm 11 moves towards the right and the valve 14 obturates the direct communication between the chamber 9 and the delivery conduit 20.

At this moment, if calibrating device 7 alone delivered fuel, the quantity delivered would be insufficient and the mixture would be too poor.

It therefore is necessary for the orifice 19 to deliver, under the action of the suction which prevails in the venturi, to obtain a suitable richness in the case where the regulating valve 2 is partially closed. For this reason there is provided the calibrated orifice 21 for making the chamber 9 and the delivery conduit 20 communicate directly. Consequently, at the partial openings of the valve 2, the delivery of the fuel is determined by the calibrated orifices 7 and 21, whilst at heavy loads and at pick-up periods the delivery is determined by the calibrated orifices 7 and 19. This arrangement, to give the best results, permits the choice of the best values for the orifices 19 and 21 to adapt them to the pick-up and enrichment periods and to the periods of normal utilisation.

Fig. 2 shows a similar device but which is so arranged that the ball or the valve 17 located in the delivery conduit 20 can be omitted. To this end there is made to intervene a chamber 22 situated, preferably, below the constant level N—N of the carburettor and communicating with the venturi, for example by a conduit 18 and an orifice 19. This chamber 22 communicates with the pick-up device downstream of the valve 14 by a calibrated orifice 23. At the moment when the spring 12 expands, producing the injection of fuel, the ball or the valve 15 located in the suction conduit is applied on its seating and the fuel contained in the chamber 9 is sent through the chamber 22 and the conduit 18 into the venturi of the carburettor.

On the contrary, when under the action of the suction the diaphragm 11 moves towards the right, a double suction takes place; on the one hand, the ball or the valve 15 rises to allow the passage of the fuel contained in the conduit 8 and, on the other hand, the fuel contained in the conduit 18 and the chamber 22 is re-aspired by the movement of the diaphragm.

The calibrated orifice 23 allows the reduction of this suction and the volume of the chamber 22 is such that the diaphragm 11 has completely resumed its position before the fuel contained in this chamber is aspired, so that, in no case air can enter the chamber 9.

Moreover, as in Fig. 1, the chamber 9 constantly communicates directly through the calibrated orifice 21 with the delivery conduit 18 so, that, as soon as the pump has terminated its movement, the constant level N—N is re-established in the chamber 22 which always has a certain volume of fuel which prevents, in all cases, the pump being able to take up air through the delivery conduit 18. The function of this calibrated orifice 21 is exactly the same is in the case of the device shown in Fig. 1.

Fig. 3 shows a device similar to that of Fig. 2, but in which the delivery takes place through a conduit 24 into the principal nozzle system of the carburettor, downstream of the calibrated orifice 7. In this case the calibrated orifice 23 is located in the conduit 24 which connects the diaphragm pump and the nozzle system. The chamber 22, situated below the constant level N—N, is constituted by the well 3 of the principal nozzle system. The operation of the pump and the function of the calibrated orifice 21 obviously remain the same as these indicated above.

In Fig. 3 there have also been shown grooves 28 which are provided in the interior surface of the body 1 of the carburettor, downstream of the regulating or throttle valve. These grooves have the following function. When the ignition circuit of the engine is interrupted for example, whilst the valve 2 is closed, the suction prevailing in the conduit 13 suddenly falls to a very low value, the spring 18 expands and a certain quantity of fuel is delivered towards the intake pipe of the engine, which causes the local level in the well 3 to rise, with the risk that the fuel will overflow through the apertures 4. This fuel is, however, delivered without violence and flows along the walls of the body 1 finally to attain the intake pipe and the engine, which interferes with the re-starting of this latter. By the provision of these grooves 28, the delivered fuel is retained by these latter and does not descend as long as the engine is stopped. If the engine is re-started and if the throttle valve 2 is opened, the current of air produced carries along the fuel which is retained in these grooves towards the engine.

It is also seen in Fig. 3 that the conduit 24 is slightly inclined with respect to the horizontal. This has for its object to produce at the position of the outlet of the conduit 24 into the feed system of the principal nozzle, a rather considerable current of liquid which augments the delivery of the calibrating device 7 and, in consequence, facilitates its priming, which is generally rather difficult from the fact that, at the moment of the fuel injection, only very little suction is available opposite the apertures 4.

Fig. 4 shows the same device as that of Fig. 3 but for which a conduit 25 permits some fuel being taken from the conduit 24, to be sent through the calibrating device 26 from which it is drawn by the current of air aspired through the orifice 27. The emulsion of fuel thus formed serves to feed the "idling" and opens into the intake pipe.

The advantage of this device is that the injection of fuel, produced by the pump, gives rise not only to an increase of delivery of the calibrating device but also allows a certain quantity of this fuel to be discharged by the conduit 25 and the calibrated orifice 26, in order to arrive with rapidity into the intake pipe of the engine.

The invention is not limited to the precise forms or details of construction described, as these may be varied to suit particular cases.

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PUBLISHED

JUNE 8, 1943.

BY A. P. C.

M. L. MENNESSON
CARBURATION DEVICES FOR INTERNAL
COMBUSTION ENGINES
Filed Jan. 9, 1940

Serial No.
313,124

2 Sheets-Sheet 1

Fig. 1.

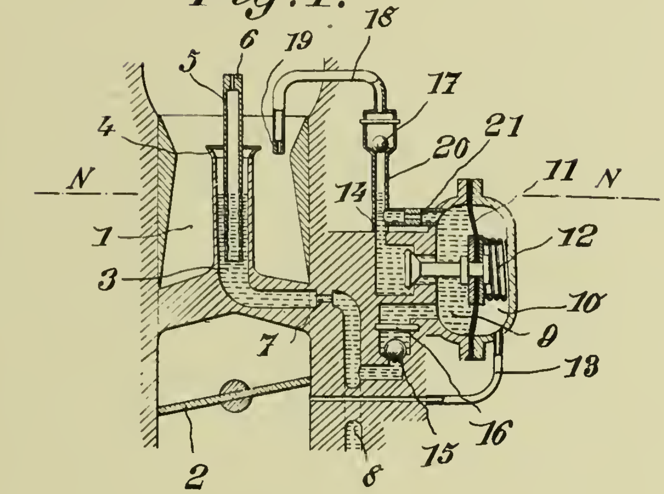
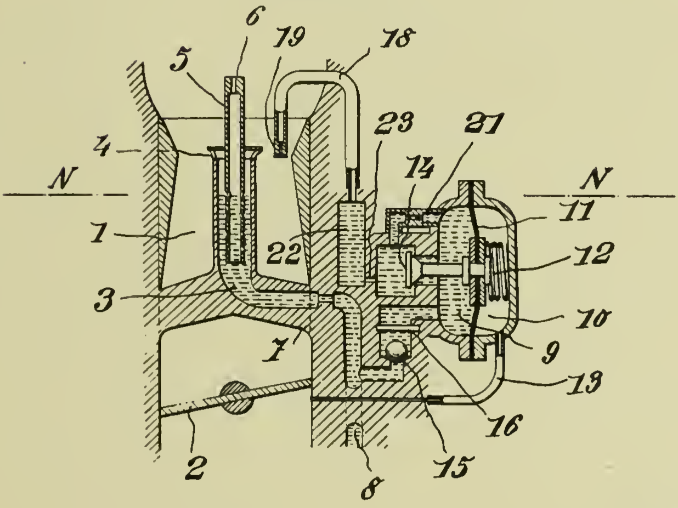


Fig. 2



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2 Sheets-Sheet 2

Fig. 3

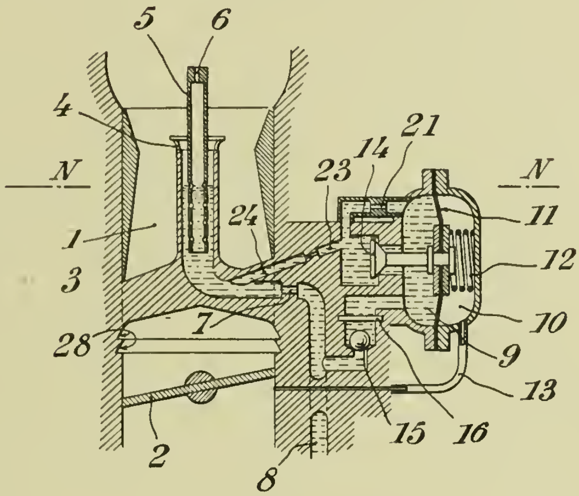
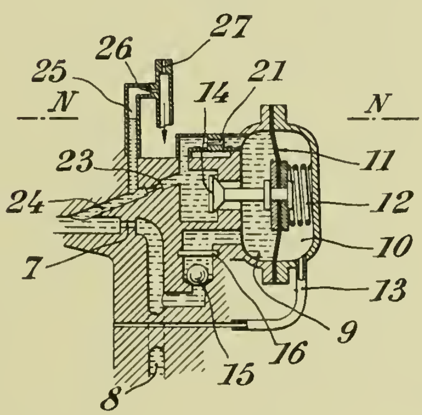


Fig. 4



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Published June 8, 1943

Serial No. 313,429

ALIEN PROPERTY CUSTODIAN

TYPEWRITING MACHINES

François Willheim, Vinay, France; vested in the Alien Property Custodian

Application filed January 11, 1940

The present invention relates to a device which is adapted to be mounted quickly on a typewriter and which consists, in principle, of an inking ribbon which is stretched, along the typing line of the typewriter, behind the sheet of paper on which the ribbon copy is made.

It is thus possible to obtain two copies of the typewritten text, viz.: a copy which is normally legible, on the front face of a sheet of paper interposed between the auxiliary ribbon and the platen of the typewriter, and another copy which is legible by transparency, on the rear face of another sheet of paper interposed between the auxiliary ribbon and the sheet of paper on which the normal ribbon copy is made. If it is not desired to obtain this second copy, it suffices to cover the corresponding face of the auxiliary ribbon with a protecting strip stretched against said face.

Just like the normal ribbon of the typewriter, the auxiliary ribbon gradually unwinds from a bobbin located on one side of the carriage of the machine and rewinds on another bobbin located on the opposite side. As for the normal ribbon, when the auxiliary ribbon has completely passed from one bobbin to the other, the drive is reversed so that said auxiliary ribbon rewinds on the bobbin it has just left.

For actuating the auxiliary ribbon, use is made, according to the invention, of the return movement of the carriage of the typewriter.

The accompanying drawing shows, by way of example, two embodiments of the object of the invention. In said drawing:

Figs. 1 to 6 relates to the first embodiment.

Fig. 1 is a diagrammatical partial front view.

Fig. 2 is a corresponding side view.

Fig. 3 is a partial plan view.

Fig. 4 is a section, on a larger scale, through the axis of a bobbin carrier case.

Fig. 5 shows the details of the mechanism for driving the auxiliary ribbon.

Fig. 6 shows a part of the members illustrated in Fig. 2, but in another position than in this figure.

Figs. 7 and 8 relate to the second embodiment.

Fig. 7 is a partial view, on a large scale, in vertical section through the axis.

Fig. 8 is a transverse section through the actuating members.

The two bobbins which serve for winding the auxiliary inking ribbon are arranged in cases 2 and 2′ at both ends of the platen 4 and in front of same, said cases being fixed by welding or other means on supporting arms 3, 3′ respectively (Figs. 2 and 3). The supporting arms 3 and 3′ extend in a curved shape adapted to the space conditions above the platen 4, and are pivotally mounted respectively in a journal hole 5 provided in a part 6 of the carriage, which part can be used at the same time as a support for the arms. The two supporting arms 3, 3′ are connected together to form a stirrup by a bar 8 by means of the bobbin carrier cases 2, 2′ and of plates 7 fixed on said cases.

As shown in Fig. 4, each of the bobbin carrier cases not only contains the bobbin 10 fixed on the shaft 9, but also the driving mechanism effecting the winding of the auxiliary inking ribbon 11, and the members for making the drive inoperative and releasing the bobbin so that the latter can rotate freely during the unwinding, and finally the adjustable supports for the protecting strip. A wheel 12 provided with teeth forming a ratchet is fixed at the inner end of the shaft 9. Above said wheel is located a thin disc 13 which is rotatably mounted on the shaft 9 and which is adapted to be locked in two positions reached by rotation. Below the ratchet wheel 12 is located a second rotatable disc 14 which is supported by means of a ball bearing on the bottom of the case 2 and is secured to a pivoting radial arm 15 placed outside the case. Between the disc 14 and the bottom of the case is placed a tensioned spiral spring 16, the inner end of which is anchored in the bottom of the case, but the outer end of which passes through a hole 17 provided in the lower disc 14 and bears with a certain pressure against a stop 18 on the upper disc 13. The feed pawl 19 is mounted on the top of the disc 14, and the stop pawl 20 on the underside of the disc 13 (Fig. 5). These two pawls are provided with wedge-shaped points and resilient arms, so that they can be brought out of engagement with the stops. The disc 14 is further provided with an arcuate slot 21 through which an abutment finger 22, fixed to the bottom of the case, projects to the height of the stop pawl 20.

In Fig. 5, the two discs 13 and 14 are shown in the positions they occupy one above the other when they are inoperative but ready to operate. The disc 13 is fixed in its position shown by means of a spring (not shown) which is fixed to the bobbin carrier case and bears against the left flank of the tooth-shaped projection 23. The point of the feed pawl 19 bears against an abutment 24 fixed to the under face of the disc 13. The drive (feed) of the ratchet wheel 12 is obtained by the pivoting of the arm 15 in the direction of the arrow *a* (Fig. 5). The disc 14 is rotated and continues to tension the spring 16. The

point of the feed pawl 19 immediately escapes by sliding from the abutment 24 and comes into engagement with a tooth of the ratchet wheel 12, so that said wheel 12 and consequently the shaft 9 of the auxiliary ribbon bobbin are rotated. This movement of the pivoting arm 15 is imparted, according to the invention, by the longitudinal movement of the carriage carrying the platen 4. For this purpose, for each bobbin carrier case and for actuating each pivoting arm 15 and 15', there is provided an actuating bar 25, 25' fixed on the stationary frame of the typewriter in such a position that its inner surface 26 or 26' is swept, each time the carriage is pushed back and consequently at each change of line, by the pivoting arm of the engaged driving mechanism. The actuating surfaces 26, 26' become inclined (as shown in the plan view of Fig. 3) in the direction in which the carriage is pushed, consequently from left to right, towards the platen 4. Owing to this, one of them (the actuating surface 26, in the case of Figs. 1 to 3) imparts to the engaged pivoting arm 15, a swinging movement towards the platen (in the direction of the arrow *a*, in Fig. 5), whereas the other pivoting arm 15', which belongs to the disengaged driving mechanism, passes in front of the outer side of the actuating bar 25' and is not actuated. As soon as the actuated pivoting arm 15 has passed the actuating bar 25, it is retracted, together with the disc 14, by the tensioned spring 16, to the inoperative position (medial position shown in Fig. 6), so that it travels, during the movement of the carriage, while the immediately following line is written, on the outer side of the bar 25 from right to left, as shown in chain dotted lines in Fig. 2. The pointed end of the bars 25, 25', where the pivoting arm actuated, 15 or 15', engages the inner actuating surface 26 or 26', is resiliently connected to the other part of the bar so that the point can escape from the pivoting arm 15 or 15' which is returning on the outer side of the bar.

The actuating mechanism of the bobbin is of course always disengaged on one of the sides of the platen (on the right hand side according to Figs. 1 and 3). In order to disengage the actuating mechanism, the disc 13 is rotated by means of the knob 27 in the direction of the arrow *b* (Fig. 5) until the spring referred to above, which is fixed to the case of the bobbin, engages behind the right flank of the projection 23. At the end of this rotary movement, the conical surface formed at the tip of the stop pawl 20 engages the abutment finger 22 fixed to the bottom of the case, so that the pawl 20 is brought out of engagement with the teeth of the ratchet. Owing to the tension of the spring 16, its end follows the stop 18. The disc 14 together with the pivoting arm 15 consequently follow the rotary movement of the disc 13, so that the feed pawl 19 does not leave the abutment 24 and therefore remains disengaged, while the pivoting arm 15 swings from the medial position (shown in Fig. 5) in the opposite direction to the arrow *a*, and consequently even when the carriage is pushed from left to right, it passes in front of the outer side of the bar 25 without being actuated.

According to the invention, all the members serving to guide the auxiliary inking ribbon 11, from the bobbins to the typing line and along same, and also the adjustable supports 36, 36' for the protecting strip 20 which, in the example shown, is stretched in front of the auxiliary inking ribbon, are also supported by the bobbin carrier cases 2, 2'. The arcuate ribbon guide plate 31, the lower end of which is provided, in the usual manner, with an oblique slit 32 for changing the direction of the ribbon, is fixed by means of a brace 33 to the bobbin carrier case 2. The outer side of said plate 31 is provided, at both ends, with bar-shaped extensions 24, 35 and acts as a guide for the likewise arcuate support 36 of the protecting strip 29. Said support 36 is of channel cross-section and engages, by means of a rounded projection 37, in a projection 38 of corresponding shape formed in a ring 39 which is inserted around the bobbin in the bobbin carrier case 2 and which can be rotated, by means of a knob 40, from a position in which the protecting strip fixed to the support 36 covers the auxiliary inking ribbon 11 (Fig. 2) to a position in which the protecting strip no longer covers the auxiliary inking ribbon (Fig. 6). The upper projection 34 of the ribbon guide plate 31 carries a small roller 28 for guiding the auxiliary inking ribbon 11 between the bobbin carrier case 2 and the guide plate 31.

The bobbin carrier cases 2, 2' are slotted over a peripheral portion 41, 41' located at the top, so that a very visible mark which is on the auxiliary inking ribbon 11 shall appear in this slot when the drive of the bobbins is to be reversed by means of the knobs 27, 27'.

It is clearly apparent from the foregoing description that all the component members of this auxiliary inking ribbon device may be manufactured and mounted in the same shape and with the same dimensions for all models of typewriters. Only the wire supporting arms 3, 3' which can be readily shaped and the very simple supports 42, 42' provided for the actuating bars 25, 25' have to be shaped and calculated in each case so as to adapt them to the model of typewriter in question. The supporting arms 3, 3' with the bobbin carrier cases 2, 2' which are fixed thereto are connected by a bar 8, the length of which corresponds to the model of typewriter, to form a stirrup which can then be fitted on the typewriter, and subsequently removed without difficulty, as a support for the whole auxiliary inking ribbon device, by simply hooking the resilient ends of the supporting arms in the previously drilled journal holes 5. In order to facilitate the insertion of the auxiliary inking ribbon between two sheets of paper, the stirrup can be swung downwards in the journal holes and completely folded down in case the auxiliary inking ribbon is not being used.

According to Figs. 7 and 8, the device according to the invention comprises two boxes 101, 102 connected together by a tube 103. The boxes 101 and 102 each carry a lug 104 (Fig. 8) forming a hook at its free end. The lugs 104 are intended to hook on to a rod A with which is provided, behind the platen, the type of typewriter for which the device such as it is illustrated is intended. This method of fixing enables the device to be lifted readily, for changing the sheets on the machine, by simply swinging it about the rod A. It is obvious that the method of fixing should and can be appropriate, in the same connection, for each type of typewriter to which it is desired to apply the device.

The box 101 contains a plate 106 which is integral with a hollow mandrel 107 on which one of the bobbins C is fitted. The plate 106 is kept in its housing by a ring 108 that allows it to rotate. It is secured to the bobbin C by a projec-

tion 109. The bobbin is kept on its mandrel by a knurled nut 110.

The box 102 also contains a plate 106′ which is integral with a hollow mandrel 107′ for the other bobbin C′. The plate 106′ is kept in its housing by a ring 108′ in such a manner that it can rotate. The knurled nut 110′ keeps the bobbin C′ on its mandrel.

Between the plate 106′ and the bottom of the box 102 is arranged a ratchet wheel 111, on the hub of which is loosely mounted a washer 112. Said washer carries a pawl 113 which is held in engagement with the ratchet by a spring 114. The washer 112 is itself connected to the box 102 by a spiral retracting spring 115 (Fig. 8). Said box is provided with a radial arm 116 projecting from the box through an appropriate opening 117 that enables it to oscillate through a certain angle. A jaw 118 is pivoted at 116′ to the arm 116 in such a manner as only to move same when said jaw is subjected to a push. Said jaw carries a roller 119 on a longitudinal spindle. The roller 119 is adapted to co-operate with a ramp, not shown, provided on a fixed part of the typewriter, on the right hand side thereof. Said ramp exerts a push on the roller 119, at each return movement of the typewriter carriage, and consequently rotates the ratchet 111.

The ratchet 111 is slidably mounted on a square part 120′ of a shaft 120 which passes through the tube 103 and which overlaps on either side of the bobbins C, C′. Said shaft can be moved longitudinally, a distance limited by the abutment, against the mandrels 107, 107′, by means of knobs 121, 122 it carries at each of its ends. The shaft 120 is further provided, towards the box 101, with a square part 120″ which is adapted to engage with a similar shaped part of the perforation of the mandrel 107.

In the position shown in Fig. 7, the shaft 120 is completely pushed towards the right. Its square part 120′, which is constantly connected to the ratchet 111, is furthermore engaged in a similar shaped part of the perforation of the mandrel 107′. On the contrary, the square part 120″ is completely disengaged from the mandrel 107. It is therefore the mandrel 107′ which is in this case actuated at each actuation of the arm 116, and the auxiliary ribbon D is wound on the bobbin C′. If, on the contrary, the rod 120 has been pushed completely towards the left, it still remains connected to the ratchet 111, but is no longer connected to the mandrel 107′, whereas it is connected to the mandrel 107. In this case it is the bobbin C which is actuated and on which the ribbon winds.

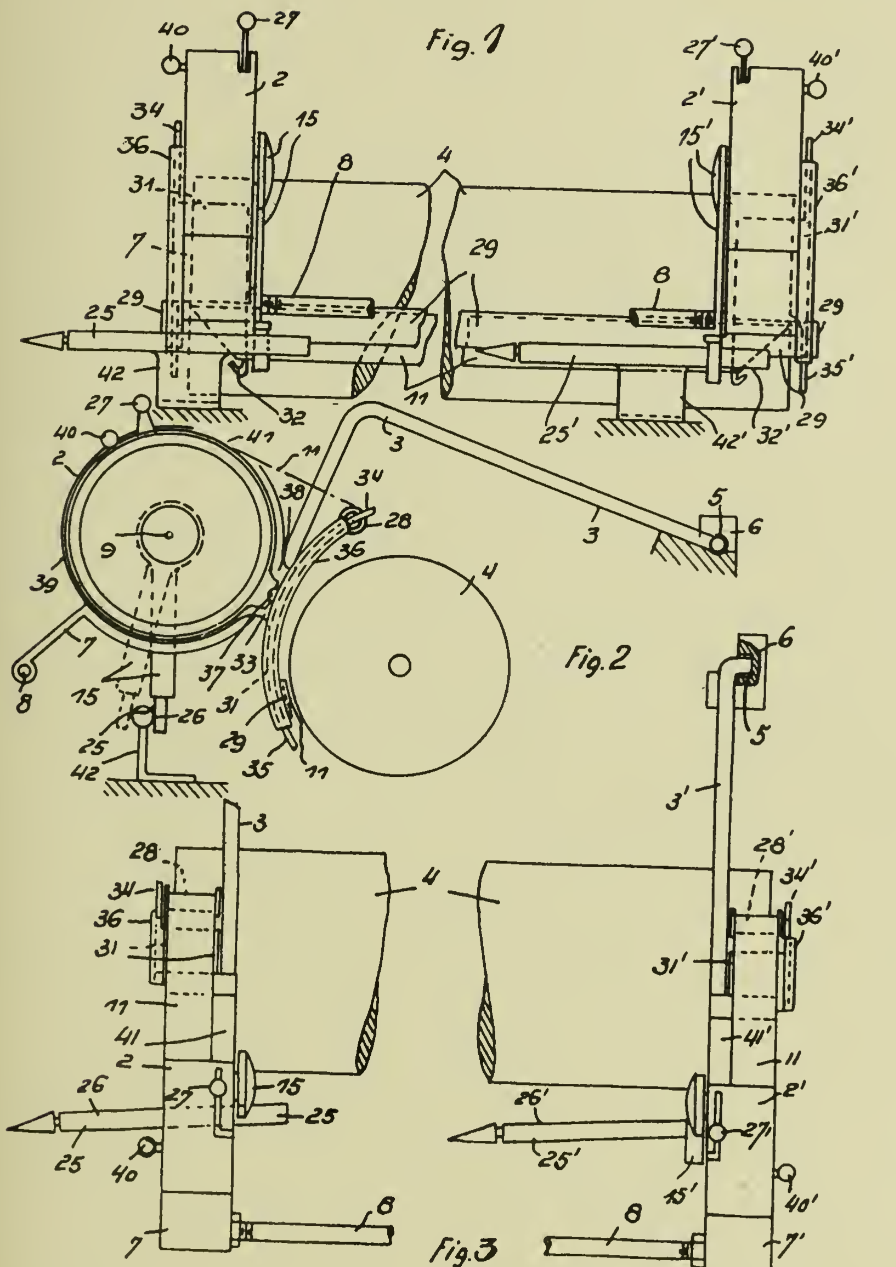
At 123—124 there have been shown the guides on which the auxiliary ribbon changes direction, as known, as it leaves and returns to the bobbins. Said guides are provided at 124 with projections which are likewise known and which serve for hooking the ends of the protecting strip with which the auxiliary ribbon is covered when it is desired to obtain only one copy of the typewritten text, as provided for in the previous case.

While I have illustrated and described the preferred forms of construction for carrying my invention into effect, these are capable of variation and modification, without departing from the spirit of the invention.

FRANÇOIS WILLHEIM.

[illegible]

PUBLISHED	F. WILLHEIM	Serial No.
JUNE 8, 1943.	TYPEWRITING MACHINES	313,429
BY A. P. C.	Filed Jan. 11, 1940	4 Sheets–Sheet 1



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TYPEWRITING MACHINES

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Serial No. 313,429

4 Sheets-Sheet 2

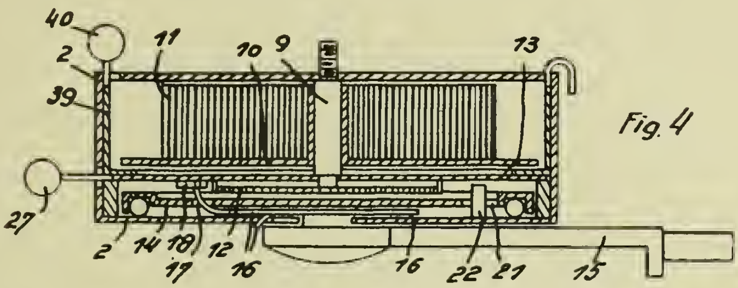

Fig. 4

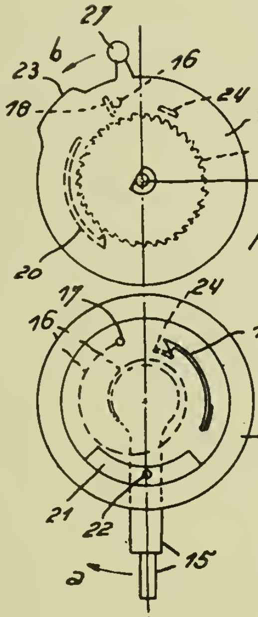

Fig. 5

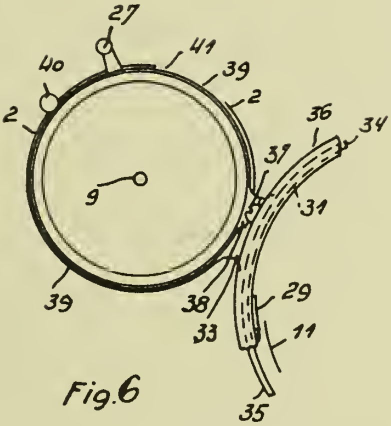

Fig. 6

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TYPEWRITING MACHINES

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313,429

4 Sheets-Sheet 3

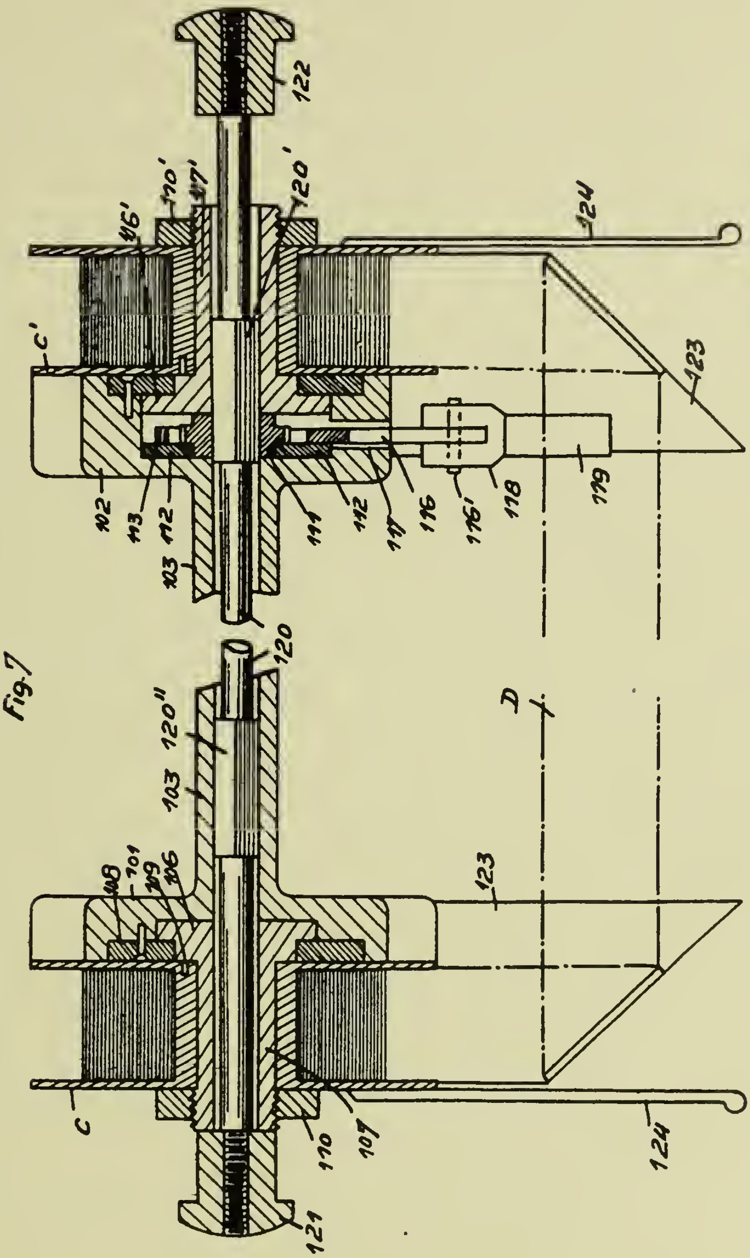

Fig. 7

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BY A. P. C.

F. WILLHEIM
TYPEWRITING MACHINES
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Serial No.
313,429
4 Sheets-Sheet 4

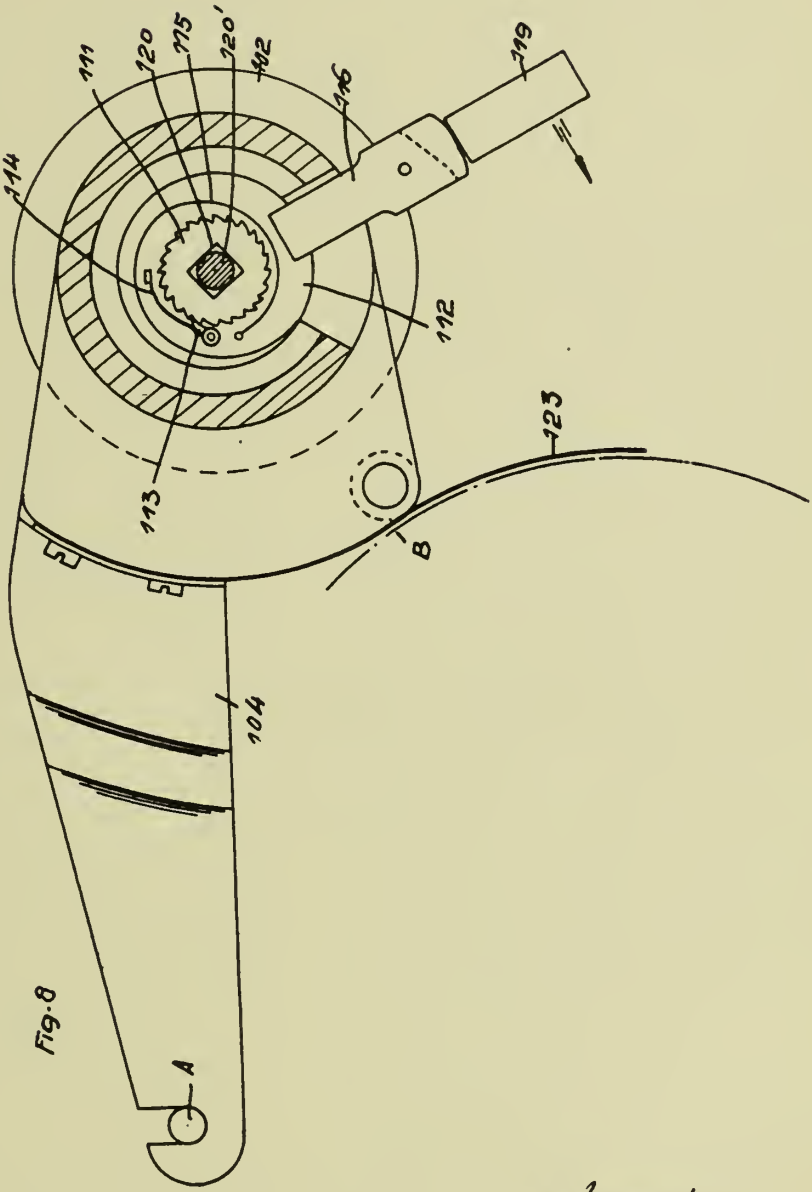

Fig. 8

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Published June 8, 1943

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ALIEN PROPERTY CUSTODIAN

PERFECTIONS BROUGHT TO ATOMIZERS FOR LIQUIDS

Luigi Mai, Nice, France; vested in the Alien Property Custodian

Application filed January 15, 1940

The object of the present invention regards perfections brought to atomizers for liquids and in special way to the type described in my patent filed in the Granducate of Luxemburg the 26th. August 1936 having the number 22,667.

The perfections permit to realize a mechanical atomizer which occupies a very little space and in which all its organs are reunited in a unic body which is covered with a cap so as to form an independent whole, which can also carry organs adapted to fix it to the receptacle containing the liquid to be atomized.

The cap also serves to action the pump and all the other organs, to keep them in their places and morcso it has the function to cover completely and block the mechanism.

To realize this atomizer the following perfections have been made:

The piston is formed by an element with a flat head carrying a stopper, on the opposite end it carries a head with a diametre larger than the piston, on which comes to lean a spring which actions the piston in its return run and does also other work which we shall describe hereafter.

This spring is wound around the outside of the piston and goes to collocate itself in a chamber extending along the outer wall of the cylinder; thus obtaining a piston "commanded by a spring" extremely short which occupies very little space, although allowing the spring to have all the elasticity and the necessary run, moreso this realization allows the piston to arrive right to the bottom of the cylinder expelling all the air or the liquid, and so obtaining the necessary and constant pression for a good atomization.

A cap covers the body and the organs of the atomizer and it is mounted movably on the same body.

A dispositive made by a fixed pivot a running pivot or a jumping pivot, allows the cap to be guided, kept or held, stopped and freed, which more than keeping the organs of the atomizer, serves to action the piston.

The spring bound around the piston has the work (more than the work above mentioned) to make the cap return always to the same position and to allow the cap, when you want to keep it in the closed position, fixed into the guiding and stopping pivot.

In order to obtain a perfect atomization I have brought to the already known atomizer dispositive, made by an element of helycoidal channel and by the usual orifice the following perfection: the head of the element which carries the helycoidal channel has the wall with the same profile of the internal chamber of the orifice, but carries a light pressing down so as to leave a space of a few tenths of millimetre, to avoid that this element functions as a valve and permitting the liquid, to which has been impressed a speedy roundabout movement, to exit from the orifice perfectly centred and in equilibrium, regulating in this way a perfect and uniform exit of the liquid which mixes itself thus with the atmosphere in the most regular conditions to obtain a very good atomization.

From the enclosed drawing the different characteristics will result in a novelty of construction, of a combination of the different pieces of the atomizer.

Figure No. 1 is a view in section of an atomizer through the axile of the piston and that of the chamber of atomization.

Figure 2 is an external view of an atomizer figuring a partial action of the dispositive which assures the guide and the stop of the cap in the working position.

Figure 3 is the same view but presents the cap blocked.

Figure 4 is an external view of the atomizer the dispositive side of the guide and blockade of the atomizer in the normal position of working.

Figure 5 is the same view in the position of the blockade of the cap and therefore of the piston.

Figure 6 is a view in section through the axile of the piston of an atomizer in which the piston and the atomizing chamber notwithstanding the cap are disposed horizontally.

Figure 7 is a view in section of the atomizing dispositive.

The liquid can be put into any type of receptacle, opened or closed and the atomizer can work dipping into the liquid of the collecting tube.

With regard to the type of atomizer represented in the Figures 1, 2, 3, 4, 5, 7, the object is composed of a body 1 having an organ of junction 2, a screw or anything else, which permits to adapt the atomizer above a receptacle adapted containing the liquid.

This body is furnished with a tube 3 which dips into the liquid and which is united to a piece holding seat 21 with the chamber 4 which contains a holding valve 5. This chamber 4 communicates on one side, with the cylinder 6 in which the piston 7 moves, recalled by the spring 8, and on the other side with the chamber 9; this chamber has a valve 10 held in a state of ease, against its seat by a recalling spring 11 which takes its leaning point on the other end against the piece 12 furnished with peripheric

helycoidal channels 13, destined to imprint a roundabout movement on the liquid which exits from the hole 17 atomized.

This piece 12 finishes at the anterior part with the conic part 14 having at the base a light pressing down 15. This pressing down allows it an absolute adherance against the internal wall of the atomizing chamber, and having a conicality about equal to that of the said chamber, it leaves a passage 16 big enough to regulate and center the liquid before its expulsion through the orifice 17.

The piston 7 which runs in the cylinder 6 is commanded by the cap 18 and it is made of a body on which is fixed a plunger 19 which assures the hold.

The recall spring 8 which allows the return of the cap, of the piston and consequently the movement of aspiration, covers the body of the piston for nearly half of the length and penetrates after into an annular chamber 20 made around cylinder 6 and high enough to allow the lodgment of the comprimed spring, when the head of the piston arrives at the bottom of the cylinder.

The action of this atomizer is the following:

You press the cap 18 which runs in the body 1 and actions the piston 7, this piston goes down to the bottom of the cylinder 6 and throws out the air completely which is therein contained. When you have finished to press the cap and the piston effects its suction movement only by means of the recall spring 8 which at the same time makes the cap return upwards.

A certain quantity of liquid becomes inhaled into the chamber 4 where the valve 5 has just been raised and then fallen back on its seat 21.

You press the cap 18 a second time, and the piston 7 throws out the eventual air again which might find itself in the channel, and then the liquid in the chamber 9 and through the helycoidal channel 13 and the passage 16 which regulates and centers the spray, before throwing it out of the orifice 17 in an atomized state.

You release the cap 18 again which returns upwards with the piston, provocating an inhalation of a new quantity of liquid, and the turn starts again at each pression exerted on the cap 18.

Another realization is represented by the Figure 6 and it is characterized by the fact that the cylinder 6 in which the piston 7 runs and the chamber 9 containing the organ of atomization are horizontal.

The cap 18 is disposed laterally on the body 1 instead of being applied on the upper part, and it is actioned through a horizontal axile. The other pieces are simil and their action is the same as the preceeding type described.

In this way we want to prove that we can make the apparatus in different ways, according to the necessity and without going away from the ambit of the invention.

The body and the cap can eventually have any form.

The dispositive figured in the Figures 2, 3, 4, 5, answer to three lists; it hinders the cap to be separated from the fixed body and on which it runs, it guides its run and allows, when wished, to block it in its lower position, avoiding that it becomes actioned accidentally.

The dispositive is formed by a piece 23 which runs in a lodgment foreseen in the fixed body 1 and pushed towards the end by a spring 22. This piece 23 bears a circular groove limiting its run by a screw or by a fixing pivot 25, it has a second circular groove 24 not too large and of a determined diametre, so as to allow the cap 18 to run on it through an opening of special form 26.

The vertical run of the cap is therefore guided by this groove which limits the run through the loophole 26, hindering the cap to go out. At last near this groove there is derived a third conic groove 27, whose diametre at the base is calculated in way to permit it to pass through the circular loophole 28 to block the cap in the following way: You press the cap 18 to push it towards the inferior part of its run; in this moment the circular loophole 28 is in front of the base of the cone 27. Then you press the button 29 of the piece 23 and you leave the cap 18 which returns up lightly leaving the space 30 between its base and that body.

The circular loophole 28 is held by the base of the cone 27 which fits itself in thus blocking the cap. To serve yourself again with the apparatus, you press the cap 18 which goes (through) down lightly covering the space 30 above indicated. Therefore the great diametre of the cone 27 is found before the circular loophole 28 and the piece 23, pushed by the spring 22, takes its normal position again thus freeing the cap.

Various modifications can be brought to the dispositive above described so as to adapt it to different cases.

LUIGI MAI.

PUBLISHED | L. MAI | Serial No.

JUNE 8, 1943. PERFECTIONS BROUGHT TO ATOMIZERS FOR LIQUIDS 313,845

BY A. P. C. Filed Jan. 15, 1940

FIG.1

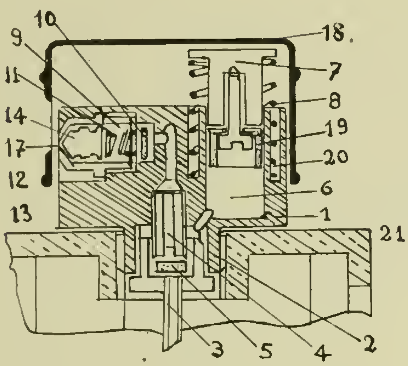


FIG.2

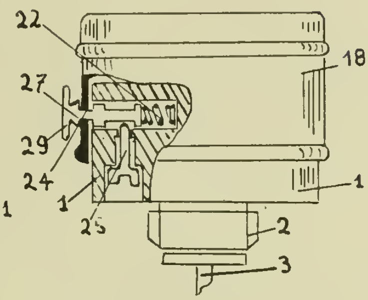


FIG.3

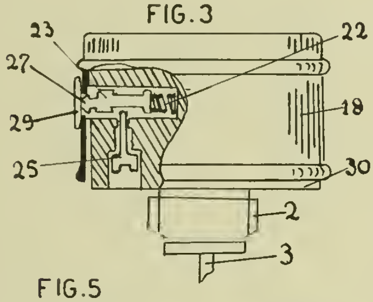


FIG.4

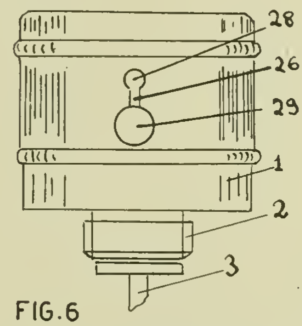


FIG.5

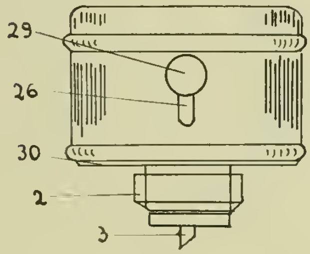


FIG.6

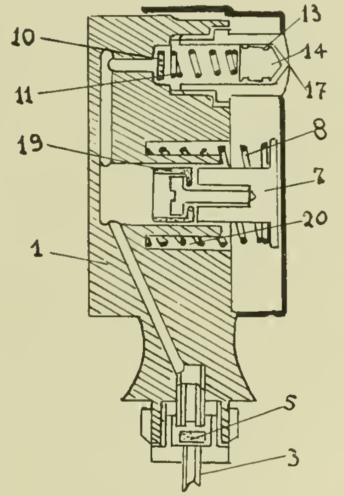
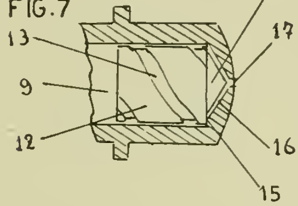


FIG.7



Luigi Mai, Inventor

By *Fraser, Myers & Manley* *his* Attorneys.

Published June 8, 1943 Serial No. 314,568

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF CATION-EXCHANGERS

Alfred Rieche, Wolfen, Kreis Bitterfeld, and Gottfried Caro, Bitterfeld, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 18, 1940

The invention relates to the manufacture of cation-exchangers from lignin substances, specific details are following hereafter.

It is known to prepare exchangers for bases by treating wood, lignite and mineral coal at low temperatures with sulfonating agents such as concentrated sulfuric acid. If, however, this method is applied to difficultly soluble or insoluble lignin substances, the utilization of which is particularly desired with regard to the fact that large quantities thereof are available, feebly cation-active substances are obtained whose stability, however, especially when they are exposed to the action of alkaline agents, does not live up to the requirements which it has to fulfill.

Now, we have found that these drawbacks can be avoided by first condensing in an alkaline medium the lignin substances difficultly soluble or insoluble in water with water-soluble sulfites, for instance sodium sulfite or sodium bisulfite, and formaldehyde. A water-soluble sulfonic acid is thereby obtained which, after evaporation to dryness, is treated at temperatures up to about 100° C, preferably at about 80° C, with sulfonating agents such as concentrated sulfuric acid, fuming sulfuric acid, sulfuric acid anhydride, chlorosulfonic acid or the like. Thereby, a water-insoluble mass capable of exchanging cations is obtained which, in comparison with the product obtained directly from the lignin by means of sulfonating agents, is considerably more active and more stable to alkalies and also to mechanical strain. It may be of advantage in the after-treatment with the sulfonating agents to add further quantities of formaldehyde.

The process may be carried through with substances difficultly soluble or insoluble in water, which are obtained by treating with alkalies, preferably under pressure, lignin-sulfonic acids, particularly those obtainable from pine wood or hard wood; it may further be carried through with lignins which are obtained by acidifying the so-called black liquors obtained in the soda wood-pulp process, for instance by means of carbonic acid. The so-called "nitro-lignin" obtained by decomposing wood by means of nitric acid is likewise applicable.

The following examples serve to illustrate the invention, but they are not intended to limit it thereto; the parts are by weight, unless otherwise stated:

Example 1.—200 parts of finely pulverized lignin-sulfonic acid, desulfonated to a considerable extent by means of alkalies, are introduced, at 80° C, while vigorously stirring, into a solution of 40 parts of caustic soda in 200 parts of water. Thereupon, 40 grams of solid sodium bisulfite are slowly added to the solution and finally 160 parts by volume of formalin of 32 per cent strength. The mass is then stirred for 6 to 8 hours at 80° C until the smell of formaldehyde is no longer noticeable, and after additions of 200 parts of water, rendered just acid to Congo paper by means of sulfuric acid. The solution is evaporated to dryness; part of the residue is stirred into about 3 to 4 parts by volume of concentrated sulfuric acid, and kept for about 4 hours at 80° C. After washing and drying the black granular product obtained is strongly cation-active.

Example 2.—According to Example 1, 200 parts of lignin-sulfonic acid desulfonated to a large extent by means of alkalies are introduced into a solution of 20 parts of caustic soda in 200 parts of water. 48,5 parts of sodium sulfite and 160 parts by volume of formalin of 32 per cent strength are then added. The condensation is complete after about 4 hours. It is then further worked up as described in Example 1.

ALFRED RIECHE.
GOTTFRIED CARO.

Published June 8, 1943

Serial No. 316,520

ALIEN PROPERTY CUSTODIAN

METHOD OF TREATING HUMAN HAIR

Dénes Bartók, Budapest, Hungary; vested in the Alien Property Custodian

No Drawing. Application filed January 31, 1940

My invention relates to a method of treating human hair, and more particularly to a method of straightening or smoothening curled hair on living persons.

Many attempts have been made to smoothen human curled hair but without much success. So far as I know, the only method which makes it possible to straighten or smoothen curled human hair for a very short time, consists in treating the hair with a substance which causes the hairs to stick together, thereby overcoming the tendency of the hairs to curl. Aside from the fact that with this known method the sticking substance on the hairs dries relatively fast whereupon the individual hairs return to their original curled condition, hair treated with the said substance looks very greasy and loses its natural appearance.

It is an object of my invention to overcome the above mentioned drawbacks and to create a method adapted to smoothen curled living human hair without causing a greasy sticky appearance.

It is a further object of my invention to provide a method of straightening or smoothening curled human hair so as to keep the hair in straightened or smoothened condition for weeks and even for months.

It is a further object of the invention to create a hair treating method of the above mentioned character which is cheap and simple in application.

While the above referred to known method of straightening curled human hair is a mere mechanical process, my new method is primarily a chemical one. It has been found that the curling of the hairs depends primarily on the location of the hair glands and the chemical composition of the hairs which are regarded as chemical compounds comprising albuminous substances, amino acids, and sulphur containing cystin links. It is believed that the albuminous substances bind the sulphur containing cystin links which latter form, so to speak, the bridges between the amino acids, thereby maintaining the curled condition of the hairs.

My experiments have proved that it is possible to change the chemical composition of the hairs by splitting up the amino acid molecules and separating the cystin links, thereby creating new holding elements counteracting the tendency of the hairs to curl. Consequently, according to the present invention, I treat the human hair with aldehydes or such compounds which are adapted to yield aldehydes. The invention furthermore includes a mechanical treatment which comprises the combined employment of heat and pressure.

Aldehydes react with amino acids, i. e. the fundamental substance of the hair, and form synthetic condensation products, for instance according to the equations:

$$\text{I.}\qquad RNH_2+H_2CO=RNCH_2+H_2O$$

(R being a radical)

$$\text{II.}\qquad \begin{array}{l} CH_2{-}SH \\ CH{-}NH_2 \end{array} + CHOH \longrightarrow \begin{array}{l} CH_2S \diagdown \\ CHNH{-}CH_2+H_2O \\ COOH \diagup \end{array}$$

As will be seen from the above equations which are given merely as examples and do by no means limit the invention thereto, various reactions are possible. It is assumed that the aldehyde reacts with the free amino groups of the lateral chains connecting the polypeptide chains. In this connection it is to be noted that due to the employment of steam new groups are formed. With regard to the second reaction, the same may be interpreted so that two molecules combine. The thus formed products constitute a resisting layer on the surface or in the interior of the hairs and prevent a curling of the hairs.

My new method is preferably carried out in the following manner:

An aldehyde solution is spread over or otherwise brought into contact with the hair to be treated, whereupon, after a short time, say for instance 10 to 12 minutes, the hair is ironed by a, preferably electrically heatable, roller. The roller may have a partially even and partially fluted or corrugated surface. If and wherever desired, the ironing of the hairs may be carried out in such a manner that a slight curling of the hair remains, thereby producing permanent waves to any desired extent.

My novel method has no harmful effect on the hair, particularly in view of the fact that in contradistinction to prior methods of producing permanent waves, the heat treatment lasts only a few minutes, e. g. 1 to 3 minutes.

After the hair is treated according to my invention, it may be washed or treated like any other hair without affecting the smoothening of the hair or disturbing the chemically prepared permanent waves. This condition will last until the treated lengths of the hairs have been replaced by new portions of the hair grown after the last treatment, varying with the speed with which the hair grows.

It is advisable to protect the skin of the head against the influence of the aldehyde, although, so far, no harmful effects have been noted when

the aldehyde solution was carefully spread over the hair. To this end, combs or comb-like plates provided with a layer of felt may be used for covering the skin of the head. At the same time, such comb or plate will prevent the heated roller from accidentally contacting the skin of the head. If desired, a protecting plate may be adjustably connected with the heated roller, or the heated roller may be associated with a second roller adapted to be adjusted relative to the first roller so that the hair to be treated may be passed between the first roller and the plate or between the two rollers respectively. The protecting plate or the second roller may also be connected with a cooling system to prevent the protecting plate or the second roller from becoming heated by the heated roller.

The treatment according to my invention is preferably carried out under a hood covering the hair to be treated while care is taken to remove or withdraw the aldehyde vapors whenever they are formed.

The hair treated according to my novel method does not change its colour, does not become brittle and does not show any disadvantages over non-treated hair. One of the outstanding features of hair treated according to my invention consists in that the hair does not lose its smoothness when getting wet.

The concentration of the treating liquid may be varied to any desired degree in accordance with the individual requirements. When using a weak solution, the hair is to be wetted two or more times and to be ironed after each wetting process.

The aldehydes or aldehydes yielding compounds are employed in aqueous solution if they are soluble in water, or are employed in emulsions or non-combustible and non-explosive organic solving means.

DÉNES BARTÓK.

Published June 8, 1943

Serial No. 318,662

ALIEN PROPERTY CUSTODIAN

PROPELLERS

Emile V. Bitterli and Max Forrer, Vitry-sur-Seine, France; vested in the Alien Property Custodian

Application filed February 12, 1940

The present invention relates to propellers and propeller blades, and more particularly to those for aircraft.

One of the objects of the invention is to provide a propeller or propeller blade that is molded and comprises a reënforce of inorganic, artificial threads or fibers imbedded in a suitable binder, said threads or fibers being of small unitary diameter, preferably less than 10 microns.

The invention and its aims and objects will be readily understood from the following description, taken in connection with the accompanying drawing of one embodiment of the invention herein given for illustrative purposes, the true scope of the invention being more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is a diagrammatic, plan view of a propeller blade embodying one illustrative embodiment of the invention, and

Fig. 2 is a cross section on line A—B of Fig. 1.

In the illustrative embodiment of the invention shown in the drawing the direction of the reënforcing thread or fibers is indicated as extending longitudinally of the blade. It is not essential, however, that all the threads or fibers should extend longitudinally of the blade, but it is preferable that the majority of said threads or fibers should extend longitudinally of the blade while the rest may be placed in no particular order or arranged in different directions. Said threads or fibers may also be disposed according to the outline or exterior shape of the propeller. A propeller will thus be produced which will offer the greatest resistance to the torque resulting from its rotation.

As the fibers herein referred to as such consist of thin filaments the term "threads" will hereinafter be used to designate fibers as well as threads.

The threads may be used in any suitable form in carrying out our invention, for example in the form of bundles, cards, twists, braids or cables. They may also be used in the form of a suitable woven fabric.

To secure the effect desired it will be found advantageous in all cases to use a quantity of threads equal to at least 30% in volume, whatever may be the form in which the thread is used. The percentage of thread may vary in different parts of the propeller; in particular it may be greater in the neighborhood of the hub than at the ends of the blades, to provide for the variations in the tractive efforts of the propeller when in use.

Referring to the drawing, the parallel lines extending longitudinally of the blade in Fig. 1 indicate only the general direction of the reëforcing threads and not the threads themselves, as the latter are microscopic and practically countless; take the case, for example, of threads of a diameter of 5 microns and a quantity of such threads equal to 30% in volume of the mass of the blade in which they are imbedded, this would give 1,600,000 threads per square centimeter of a cross section of the blade.

For this reason also the dots diagrammatically indicating the threads in the sectional Fig. 2, only represent the direction of the divided threads and not a cross section of the actual threads nor their number.

The threads used in accordance with our invention may be of glass, silica or analogous materials, or of metal, used either singly or in combination, or in combination with threads of other materials or other charges.

The binder may consist of any suitable plastic material having as a base rubber or synthetic resins of the type of phenol-formol, cresol-formol, urea-formol, glycerin-phthalic acid or vinylic acid or others.

To obtain a propeller possessing great mechanical strength and a high limit of elasticity it is preferable to use a binder of less or at most the same rigidity as that of the threads. In other words it is preferable that the modulus of elasticity of the binder be less or at most equal to that of the threads.

Adherence of the threads and the binder may be improved by treating said threads with a suitable chemical to roughen their surface, or by depositing thereon an uneven material or by varnishing or lubricating or by otherwise suitably treating said threads.

The propeller embodying the present invention will preferably be made by molding the threads and binder together under pressure, or by impregnation, under pressure, of a previously prepared fibrous reënforce, which also is a form of molding.

The different blades of a propeller embodying our invention may be molded simultaneously, particularly in the case of a two blade propeller, or separately, especially in the case of propellers having a variable pitch, and then mounted upon the common hub.

We are aware that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and we therefore desire the present embodiment to be considered in all respects as illustrative and not restrictive.

EMILE V. BITTERLI.
MAX FORRER.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

E. V. BITTERLI ET AL
PROPELLERS
Filed Feb. 12, 1940

Serial No.
318,662

FIG. 1

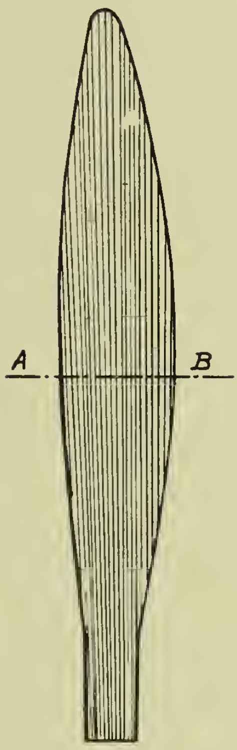


FIG. 2

Inventors

Emil V. Bitterli.
Max Forrer

Published June 8, 1943

Serial No. 318,663

ALIEN PROPERTY CUSTODIAN

MOLDED MATERIAL

Emile V. Bitterli and Max Forrer, Vitry-sur-Seine, France; vested in the Alien Property Custodian

No Drawing. Application filed February 12, 1940

This invention has for its object a molded material having great mechanical strength, and to objects made from said material.

In the present state of the art relating to rigid molded materials it has as yet not been possible to produce such materials capable of standing very heavy mechanical strains.

In order to increase their mechanical strength it has been proposed to incorporate in plastic materials certain fibers generally vegetable fibers or even a metal reenforce, but so far without obtaining the desired result.

Cotton fibers which also are often used do not produce, under the most favorable conditions, molded objects possessing a resistance to traction exceeding about 1500 kilograms per square centimeter. On the other hand it has also been proposed to reenforce objects by means of threads of metal or metal trellis work relatively coarse, but the objects thus manufactured are coarse and lacking in homogeneousness so that the resistance to traction varies from one plane to another.

The result is that in order to secure a rigid molded body possessing great mechanical strength it is not sufficient to reenforce it, nor to reenforce it with strong threads.

The invention and its aims and objects will be readily understood from the following description of embodiments thereof herein given for illustrative purposes, the true scope of the invention being more particularly pointed out in the appended claims.

In accordance with our invention a molded material is obtained composed essentially or exclusively of fibers and a binder, and possessing mechanical strength of a much higher order than that possessed by known materials by using at least 30% by volume of inorganic and artificial threads, each consisting of one or a plurality of unitary fibers of a diameter less than 10 microns, the greater portion of said threads being directed in the same direction, said material being produced in a rigid state by molding under pressure or by impregnation of the reenforce of threads under pressure.

It has been stated above that the greater portion of the threads is directed in one and the same direction. However, in accordance with our invention molded objects may be made in which layers of directed threads are used in alternation either with layers of woven threads or with layers of threads directed perpendicularly or otherwise or even disposed in bulk, provided that the majority of the fibers are directed in one and the same direction.

Among the threads of various materials which can be used in accordance with our invention may be cited fibers of glass, of silica, of quartz or of metal.

The use of glass fibers imbedded in plastic material is already known in the case of electric insulations, and it has also been recommended in cases where incombustibility and a higher resistance to chemical agents are necessary. But heretofore no one had imagined that it would be possible, by a judicious use of such fibers, to produce not an insulating material but a material of rigid construction possessing a very high mechanical strength and which could be made in any shape desired by molding. The field of application of molded objects is thus greatly extended.

In preparing a material for molding comprising a high percentage of ordered threads formed of fibers so fine, as above stated, it will be noted that said fibers mix excessively well with the binder which is entirely retained at the surface of said fibers and particularly in the capillary spaces between said fibers. If, while maintaining a given volume of fibers the diameter of the fibers be reduced, one witnesses a sudden increase in mechanical strength; thus a mixture of phenolic resin and glass fibers of 15 to 18 microns produces a quite brittle and weak product, while with fibers of from 4 to 5 microns the material produced is of extraordinary strength and acts like a more homogeneous material. This rather sudden change in physical properties as soon as a certain degree of fineness and a certain division of the fibers and of the binder is attained would seem to indicate the intervention at a certain point of new forces due to the small dimensions of the bodies present or to the great development of their surfaces, such as surface tensions, adhesive tensions, absorption, etc. Similar phenomena are met with when uniting two surfaces with the aid of an adhesive, the adherence being all the more strong the thinner the intermediate layer of adhesive, for example in application of hydraulic cements, in the pliable rubber industry which uses colloidal charges, called "active" for obtaining very tenacious materials, etc.

Material embodying the present invention made of parallel glass fibers of a diameter of 4 to 5 microns and phenolic resin possesses a tensile strength in the direction of said fibers equal to more than 3000 kilograms per square centimeter. Said material is therefore much stronger than all the molded materials known.

Another important feature of the invention

resides in the choice of a binder that is less rigid or at most as rigid as said fibers. In other words it is advantageous to have the modulus of elasticity of the binder inferior or at most equal to that of said fibers. Materials are thus obtained possessing a high limit of elasticity, close to the rupturing charge. These materials may be subjected for an unlimited time and in perfect safety to mechanical stresses much higher which in the long run would wear out and disintegrate any other known molded material.

Said threads may be formed of parallel, twisted, or braided fibers or fibers in the form of cables.

It is advantageous to use very long unitary fibers, such as those obtained by drawing. However the shorter fibers obtained for example by the dispersion of melted glass in a steam jet may also be suitable. The glass, metal or other threads may be used each sort alone or mixed with one another or mixed with other fibers or charges.

The adherence between said fibers and the binder may be improved by chemically treating said fibers to roughen their surface or by depositing thereon an uneven substance, or by varnishing or suitably lubricating said threads.

The binder used may consist of any suitable plastic material, a material for example having as a base natural or synthetic rubber or a synthetic resin of the type of phenol-formol, cresol-formol, urea-formol, glycerin phthalic acid, vinylic glycerin acid, or the like.

The materials embodying the present invention are made either by molding under pressure the mass of the fibers and binder or by impregnation of a previously formed fibrous reenforce and subjected to pressure, an operation which is also a form of molding.

The exceptional mechanical strength of the rigid molded materials embodying the present invention enables them to be used for the manufacture of parts which are subjected to very heavy mechanical stresses; attempts to apply molded materials heretofore known to such uses have invariably failed, said known molded materials having proved wholly inadequate.

We are aware that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and we therefore desire the present embodiments to be considered in all respects as illustrative and not restrictive.

EMILE V. BITTERLI.
MAX FORRER.

Published June 8, 1943 Serial No. 322,422

ALIEN PROPERTY CUSTODIAN

DEVICE FOR CONVEYING WIRES THROUGH CLEANING, PICKLING OR PLATING BATHS

Theodor Weinberger, Berlin-Zehlendorf, Germany; vested in the Alien Property Custodian

Application filed March 5, 1940

The invention relates to a device for conveying wires through cleaning, pickling or plating baths.

It has been proposed for conveying wires in an even manner to use several rotatable rollers arranged in a circle in a bath which rollers while rotating in the same direction and with the same speed will accomplish the conveying of the wires through the baths. When such an arrangement of conveying rollers for plating wires is used, already one or more current admitting or contact rollers have been provided for and made to rotate at the same conditions as the conveying rollers. An endless chain or a spur wheel and pinions fast to the axes of the conveying and contact rollers are used for actuating said conveying or contact rollers. Rakes arranged on the conveying rollers and provided with combs corresponding to the number of windings of the wires serve for spacing of the wires.

The device according to the invention comprises a set consisting of conveying and contact rollers arranged in a circle each roller being rotatable about its axis for conveying the wires through the bath, the set itself being adapted to be held fast and further comprising an actuating device permitting to stop the rotation of the conveying and contact rollers about their axes and to rotate only the set of rollers itself about its own axis with a view of winding up the wires to be treated.

The subject of the invention is represented in the drawing by an embodiment as an example.

Fig. 1, shows a front view of the device during the conveying process,

Fig. 2, a plan view of the Fig. 1, and

Fig. 3, shows the front view of the device during the winding up.

The device comprises several sets of rollers whereof only one single shall be described. This set comprises eight conveying rollers **1**, for instance made of glass which during the operation are immersed into a non-represented container and convey the wire to be galvanized and which is first to be scoured. These conveying rollers are rotated by means of a shaft **3**, bevil wheels **4**, a vertical shaft **5**, spur wheel **8** and pinion **9** and besides there are provided two contact rollers **2** which while using the same operating mechanism are rotated by means of a spur wheel **6** and a pinion **7** in the same direction and with the same circumference speed as the conveying rollers **1**. The axles of the conveying and contact rollers turn in bearings fast to the movable plate **10** which plate rests by means of balls **11** on a stationary plate **12**.

In ordinary service (compare Fig. 1) plate **10** is prevented from rotating on its central axis by a pawl **13** hinged to plate **12**, wherefore only the conveying and contact rollers **1** and **2** rotate on their axes said rollers conveying the helically wound up wire across the scouring respectively the galvanic bath.

With a view of winding the wire mechanically up to the conveying and contact rollers a coupling **14** is arranged slidably on the shaft **5** and by means of intermediate rods **16** is brought into engagement with the dogs **17** on the bearings **18** of the conveying and contact rollers when the levers **15** pivotally attached to pin **14'** on a bracket **14''** fast to spur wheel **6** are lifted up. Then the final position of the thrown-in coupling **14** will be maintained by the stays **19** swung into position. When pawl **13** has been removed, plate **10** resting on balls **11** will rotate about the central axis of the set together with the conveying and contact rollers but without rotating these latter about their axes. When plate **10** rotates in this way with the non-rotated rollers the wires to be treated will be wound up helically upon the set and be guided by a simple contrivance not represented in the drawing by the rakes **20** provided for.

After the winding up of the wires to the set of rollers the coupling **14** will be lowered by lifting up lever **15** and pawl **13** will be engaged into plate **10** (compare Fig. 1) whereupon the conveying and contact rollers rotate about their axis and convey the wire to be treated still further.

In order to prevent, in the case where the described device is used for galvanizing wires, that these wires be provided with less plating on the side facing the conveying rollers than on the opposite side, the wire to be galvanized shall be conveyed through two bathes having the same composition and arranged one behind the other in such a manner that the wire after having passed the first bath is turned by a well known and therefore not represented contrivance and will have in the second bath that side turned to the outside which was turned to the inside in the first bath. By this arrangement also small mechanical surface defacts which may have occurred by a casual slipping of the wires over the conveying and contact rollers will be removed by one and the same operation.

THEODOR WEINBERGER.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

T. WEINBERGER

DEVICE FOR CONVEYING WIRES THROUGH
CLEANING, PICKLING OR
PLATING BATHS
Filed March 5, 1940

Serial No.
322,422

Fig. 1.

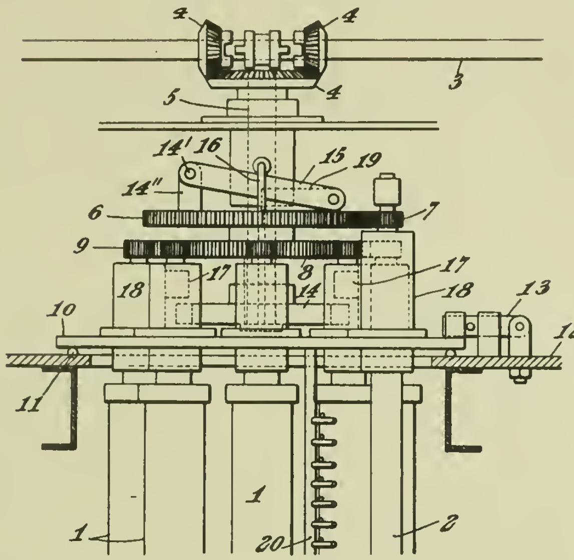


Fig. 2.

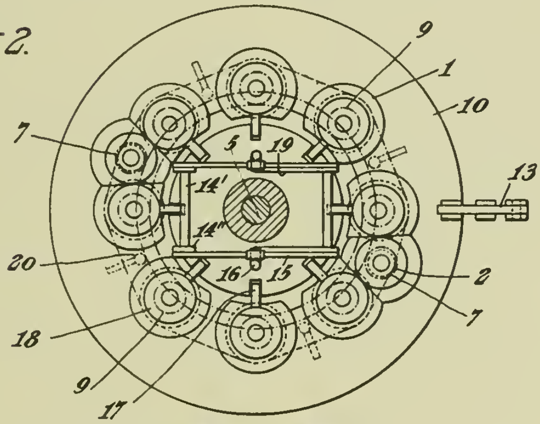
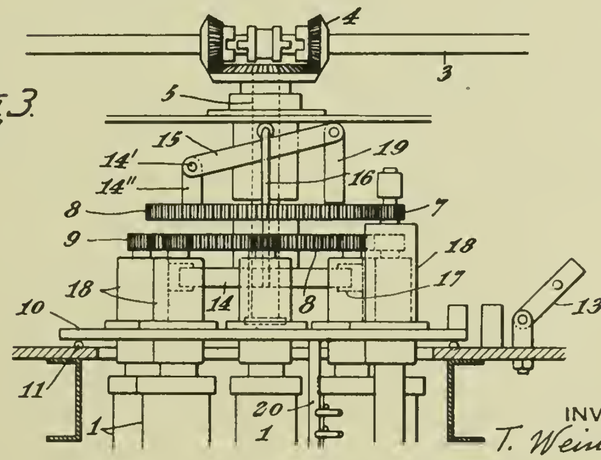


Fig. 3.



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Published June 8, 1943 Serial No. 328,538

ALIEN PROPERTY CUSTODIAN

EXPANDING DEVICES FOR PISTON RINGS

Pierre Bollée and Marcel Bollée, Le Mans, France; vested in the Alien Property Custodian

Application filed April 8, 1940

This invention relates to the expanding devices for piston rings and more particularly to a compensating device of such a nature.

The usual expanding devices for piston rings are, generally speaking, obtained by bending a steel blade or band so as to bring said band, for instance, to the shape shown in Figs. 1, 2, 3. The shape of said expander is a polygonal one as shown in Fig. 1. The apexes of the polygon may be rounded, while the sides are either straight or curved. The number of said sides is generally speaking from five to eight.

Such expanders are used in the following manner, shown in Figs. 1 to 3:

The expander is introduced into the groove **1** of the piston **2** (Fig. 2). The piston ring **3** is afterwards introduced into said groove and surrounds the expander indicated by the reference **4**. As shown in said Fig. 2, the expander abuts in the very bottom of groove **1**, as at **5**, **6**, **7**, **8**, **9**, **10**, about in the middle part of the length of each of the sides of the polygon constituted by said expander. Said expander forces the piston ring as at the points **11**, **12**, **13**, **14**, **15**, **16**, that is at the apexes of the polygon.

The distance between the bottom **17** of the piston groove and the internal face **18** of ring **3** is generally speaking a very small one. On another hand, the sides of the polygon constituted by the expander must have a rather important length owing to the fact that the length of such elements is an important condition of the resiliency of the expander.

It results of above two particulars that the curvature of the expander in its position of work takes place in the direction shown in Fig. 3, the center of said curvature being located inside of the geometrical figure constituted by the expander.

The piston ring is kept applied against the cylinder wall so that the external diameter of said ring is always equal to the internal diameter of the cylinder. Said diameter is variable if the cylinder is worn for the reason that the wear of the cylinder is unequal in the several parts of said cylinder, and more particularly in the upper end and in the lower end of the cylinder, so that the internal diameter of the piston ring is also a variable one.

Owing to the fact that the piston and the cylinder are both subjected to the wear, the piston has some clearance in the cylinders and may displace itself transversely in said cylinder.

Above consideration explains that the distance between the bottom **17** of the groove and the internal face **18** of the piston ring **3** is variable.

Let us consider an expanding element such as the one shown in Fig. 3; such element is comparable to a spring blade or sheet. The variations of the distance between the bottom of the groove **17** of the piston and the internal diameter **18** of ring **3** cause flexions of the spring sheet constituted by the expanding element of Fig. 3 to take place, said flexions being accompanied with displacements of the points **13** and **14** where the expander forces the internal face of ring **3**.

The expander parts which are adjacent to the part of said expander shown in Fig. 3, are submitted to the same flexion as said part and even all parts of the expander are simultaneously subjected to said flexions. The simultaneous displacements of points **11**, **12**, **13**, **14**, **15**, **16** add together and cause a considerable friction to take place between the expander and both the ring and the piston groove. Such friction reduces the resiliency of the expander and it may also in some way even prevent the action of said expander, which may result in the piston rings to be early worn.

The expander according to this invention, which remedies above drawbacks, comprises in combination with sides or parts of straight or curved active spring elements, compensating elements connecting the spring elements, said compensating elements having a resiliency different from that of the active resilient elements of the expander, for what concerns either the degree, or the importance, or the direction of the resiliency, or the combination of two or more of said particulars, with a view of preventing the totalisation of the displacements of the leaning points of the spring elements constituting the expander thus considerably reducing the friction of the expander, the resiliency of said expander being thus not hindered thus obtaining a better action of said expander.

In the accompanying drawings which show as an example of an embodiment of the invention, a preferred constructional form of expander according to said invention:

Figs. 1 to 3 are explaining figures showing the usual expander hitherto applied to piston rings,

Fig. 4 is a plan view of an expander according to this invention,

Fig. 5 shows said expander in a position of operation on a piston,

Fig. 6 shows on a larger scale a detail of the expander of Fig. 5, for showing the mode of operation of said expander.

The expander according to this invention com-

prises as shown in Fig. 4 a metal band bent under the shape of a polygon, the sides of which, 19, 20, 21, 22, 23, 24, which may be either straight or curved and which constitute the spring elements of the expander, are connected with each other by compensating elements 25, 26, 27, 28, 29, which have a sufficiently small length so as to allow said compensating elements to possess and keep in position of operation a curvature which is opposed to that of the spring elements constituted by the sides of the polygon.

It is clearly seen in Fig. 6, which shows the parts in position of operation, that the centers of curvature of the compensating elements such as 25, 26, are located outside of the polygon constituted by the expander, whilst for such a position of work the center of curvature of the spring elements constituted by the part 20 of the expander is located inside of the said polygon.

It is seen in Fig. 4 that the compensating elements 25, 26, 27, 28, 29, comprise a reduced thickness which is designed for increasing the resiliency of the spring elements of the expander. Such a result could also be obtained by reducing the width of the band which constitutes the expander at the places of the band which form compensating elements, or by perforating said band in the said places or in any other manner.

The points 30, 31 which constitute the ends of the part 20 of the expander, through which said part 20 leans against the internal face of the ring 3, tend to come nearer each other if the distance between the face 17 of the groove bottom and that 18 of ring 3, is reduced.

It is thus easily seen that the leaning points 30, 31 of the corresponding compensating element 25 tend to depart.

It is thus seen that a modification of the spacing apart of surfaces 18 and 17 results for instance in a reduction of length of arc 25, and an increase of the length of arc 20.

The shape of the expander is such that the total of the lengths of both arcs 20 and 25, remains unaltered for all the conditions of operation of said expander. The displacements of the leaning points 30 and 31 (Fig. 3) are thus absorbed by the friction of the compensating elements.

It results that the displacements of the leaning points of the spring elements constituted by the parts 19, 20, 21, 22, 23, 24 of the expander, are not to be totalised in the contrary of what happens in the hitherto used expanders shown in Figs. 1 to 3.

The leaning points 33, 34, 35 of the expander, on the bottom 17 of the piston groove 1, are unmovable. The friction of the expander is thus extremely reduced and the resiliency of same is not hindered.

The compensated expander may be rendered stationary relatively to the ring, for instance by locating the ends 36, 37, of said expander into recesses 38, 39 of the ring 40 located on either side of the gap 41 of said ring, as shown in Fig. 5. Of course, the compensated expander may be used without being hooked with said ring and it may be mounted in the manner shown in Fig. 2 for the known expander.

The expanders may be applied either to usual piston rings or to piston scraping rings. In the latter event the expander may be notched or perforated in order to allow the oil to pass inside the expander.

Instead of constituting the expander as a continuous band having a resiliency increased at the places of the compensating elements, said expander could be constituted by independent blades or sheets constituting spring elements, said blades or sheets being connected for instance by means of wires or blades, which may be thinner than the expander sheets themselves and having consequently a conveniently different resiliency, the connection of the compensating elements and of the sheets constituting spring elements being effected by riveting, soldering, pivoting, or anyhow.

The expander could also be constituted by a thin band or sheet having the polygonal conformation shown in Fig. 4, the parts which are to constitute spring elements corresponding to parts 19 to 24 of Fig. 4, being conveniently reinforced, said reinforcement being effected either by bringing on said parts additional sheets or blades, or in any other way.

The invention applies to expanders used for the tightening rings for pistons of motors, pumps, and like machines.

MARCEL BOLLÉE.
PIERRE BOLLÉE.

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JUNE 8, 1943.
BY A. P. C.

P. BOLLÉE ET AL
EXPANDING DEVICES FOR PISTON RINGS
Filed April 8, 1940

Serial No.
328,538

Fig. 1

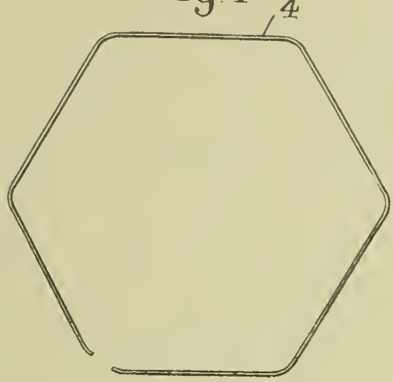


Fig. 2

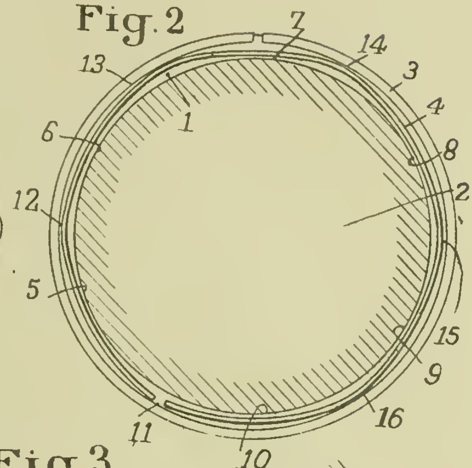


Fig. 3

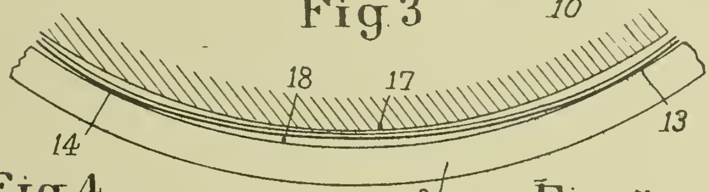


Fig. 4

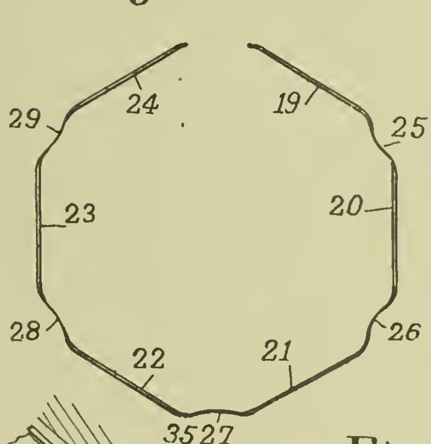


Fig. 5

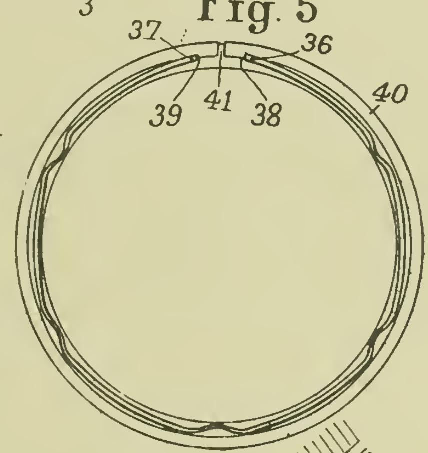
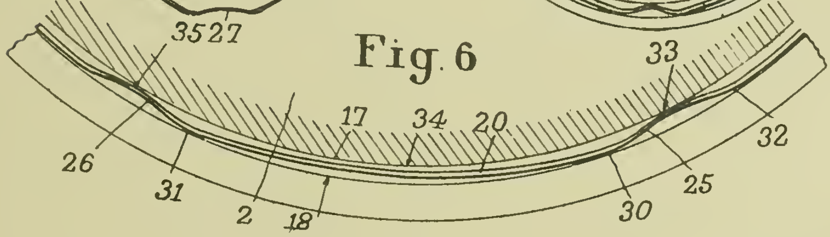


Fig. 6



Inventor,
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By: Glascock Downing & Seebold
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Published June 8, 1943

Serial No. 334,582

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF ALIPHATIC DICHLORO COMPOUNDS

Hans-Georg Trieschmann and Friedrich Manchen, Mannheim, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 11, 1940

The present invention relates to the production of aliphatic dichloro compounds and particularly to the preparation of 1.4-dichlorbutane and 4.4'-dichlordibutyl ether by the interaction of hydrogen chloride and tetrahydrofurane.

The synthesis of aliphatic dihalogen compounds is well known as, for example, the preparation of 1.4-dibrombutane from 1.4-dihydroxybutane or from ethers or esters thereof and hydrogen bromide. These processes have been considered of little interest for commercial preparation of these compounds owing to the relatively small rate of conversion.

An object of the present invention is to provide an improved process for the synthesis of 1.4-dichlorbutane and at the same time to provide a simple process for the production of 4.4'-dichlordibutyl ether having the structural formula:

$$ClCH_2CH_2CH_2CH_2O.CH_2CH_2CH_2CH_2Cl$$

According to the present invention hydrogen chloride is allowed to act on tetrahydrofurane at temperatures exceeding 100° C under superatmospheric pressure. In order to effect the reaction as complete as possible, the pressure employed should be so high that at least part of the tetrahydrofurane is in the liquid phase, the total pressure corresponding to the vapor pressure of all constituents of the reaction mixture at the reaction temperature. By employing inert diluent gases, such as nitrogen, the pressure may be increased beyond the pressure of the reactants, for example up to 50 or 100 atmospheres or even more.

The reaction proceeds with fairly satisfactory conversion already at temperatures between 100° and 120° C. The most suitable temperature is within the range of 120° to 165° C. Temperatures exceeding 165° C cause the formation of higher molecular by-products and are not practicable.

The relative proportion of the reactants can be varied although it has been found that very advantageous results are obtained when the hydrogen chloride is in excess with respect to the tetrahydrofurane. In order to obtain 1.4-dichlorbutane as the main reaction product, at least two molecular proportions or even more, e. g. 2,5 or 3 molecular proportions, of hydrogen chloride for each molecular proportion of tetrahydrofurane should be employed at temperatures between 140° and 165° C. The proportion of 4.4'-dichlordibutyl ether in the reaction product may be increased by using from 1 to 2 molecular proportions of hydrogen chloride for each molecular proportion of tetrahydrofurane at temperatures between 130° and 150° C.

The reaction may be carried out for example by charging liquid tetrahydrofurane into a pressure-tight vessel, pressing in anhydrous hydrogen chloride and then heating to reaction temperature. The hydrogen chloride may also be pressed in during or after heating the tetrahydrofurane. The formation of 4.4'-dichlordibutyl ether is particularly favoured when pressing in the amount of hydrogen chloride required for the reaction in small batches or in the form of a slow current into the hot tetrahydrofurane enclosed in a pressure-tight vessel.

Catalysts may be employed in our process, through the conversion of tetrahydrofurane into 1.4-dichlorbutane and particularly into 4.4'-dichlordibutyl ether is highly satisfactory without the aid of catalysts. Suitable catalysts are those which have proved suitable for promoting the formation of alkyl halides from olefines and hydrogen halides, such as metal halides, e. g. the chlorides of iron, bismuth, mercury, zinc or calcium, or iodine or active carbon, silica gel and the like which may be impregnated with a metal salt of the type referred to above.

The following examples will illustrate methods of practizing the invention although the invention is not limited to the examples.

Example 1

In a pressure-tight vessel made from steel of 1 liter volume 144 grams of tetrahydrofurane and 200 grams of anhydrous hydrogen chloride are heated at 150° C. for 5 hours. The reaction mixture is distilled, thus yielding 175 grams of 1.4-dichlorbutane corresponding to a yield of 70 per cent.

Example 2

In a pressure-tight lead-lined autoclave of 2 liters volume 700 grams of tetrahydrofurane and 2 grams of bismuth trichloride are heated to 160° C whereby a pressure of 15 atmospheres is reached. 725 grams of anhydrous hydrogen chloride are slowly pressed in, and the whole is kept at 160° C for 8 hours. By fractional distillation of the reaction mixture, there are obtained 1050 grams of 1.4-dichlorbutane and 100 grams of 4.4'-dichlordibutyl ether.

Example 3

Into a pressure-tight enamelled vessel of 30 liters volume there are charged 7 kilograms of tetrahydrofurane and 20 grams of bismuth chlo-

ride. 7.25 kilograms of anhydrous hydrogen chloride are pressed in and the whole is heated to 160° C for 5 hours. By fractionating the reaction mixture 11.6 kilograms of 1.4-dichlorbutane are obtained which corresponds to a yield of 94 per cent.

Example 4

7 kilograms of tetrahydrofurane are heated in a pressure-tight enamelled vessel of 40 liters volume to 140° C. In the course of 8 hours 5 kilograms of anhydrous hydrogen chloride are pressed in. When fractionating the resulting liquid, 1.7 kilograms of 4.4′-dichlordibutyl ether and 2.5 kilograms of 1.4-dichlorbutane are obtained. There is also formed some 1-chlor-4-hydroxybutane which can be easily reconverted into tetrahydrofurane.

Example 5

In a vessel as described in Example 4, 7 kilograms of tetrahydrofurane are heated to 115° C. 5.5 kilograms of the anhydrous hydrogen chloride are pressed in in the course of 8 hours. 1.65 kilograms of 4.4′-dichlordibutyl ether and 1.35 kilograms of 1.4-dichlorbutane are thus obtained. Part of the tetrahydrofurane is converted into 1-chlor-4-hydroxybutane.

Although the reaction is preferably carried out with the aid of pure, substantially anhydrous hydrogen chloride, since aliphatic dichloro compounds are produced in maximum conversion, the reaction may also be carried out with hydrogen chloride containing other gases, e. g. nitrogen or oxygen or water.

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Published June 8, 1943

Serial No. 340,606

ALIEN PROPERTY CUSTODIAN

MEANS FOR FASTENING SHOES ON SKIS

Bror With, Oslo, Norway; vested in the Alien Property Custodian

Application filed June 14, 1940

This invention relates to that type of ski-bindings where the sole of the shoe is pinched to the ski by means of a lever or the like adapted to press or pinch the sole against the ski, in other words that type where the presence of binding means around the heel of the shoe is unnecessary.

In a ski-binding of this type the point of attachment of the sole to the ski will be determined by the point of contact between the pressing member and the sole of the shoe, the relation between the shoe and the ski being fixed in known manner by means of suitable side guides for the sole of the shoe. When skiing under varying conditions of snow and also when performing different style of skiing, however, it is valuable to be able to vary the point of attachment between the sole of the shoe and the ski, counted in the direction of the length of the shoe, in order to change the lever action between the shoe and the ski. In the bindings of this type, which is known per se, this point of pressure has been fixed once and for all at the time of mounting the binding, and the skier has had no opportunity to change this point according to his own wish and in relation to the conditions under which skiing is performed.

The object of this invention is to provide a ski binding of the type described, where means are incorporated in the binding to make an adjustment possible in the direction of the length of the shoe or the ski of the point of pressure of the lever or like means, in order to facilitate the adaptation of the ski binding for use under varying conditions or for varying styles of skiing, at the same time as a correction of the point of pressure against the sole of the shoe may save this for unnecessary strain.

In order to fulfill this object, this invention consists in a ski binding with pressure means adapted to pinch the sole of the shoe to the ski, where the said pressure means are arranged in such a manner that they may be moved in the longitudinal direction with reference to the length of the ski or the shoe, to move the point of application of the pressure against the sole of the shoe in accordance with varying requirements or wish of the user.

When attempting to describe the invention it is not possible to refer to specific embodiments, due to the fact that the invention must be adapted to different types of ski bindings of this style, and in accordance with the specific features of each style of binding. It is however easily understood that it by the help of simple means can be arranged for the longitudinal adjustability of the pressure organ in the different well known types of such bindings, and to fix the pressure member in place when so adjusted. It is thus feasible to arrange the pressure member slidable and fixable in a longitudinal slot in the side members of the toe piece of the ski binding, or it is possible in the toe piece to arrange a number of fastening holes into which a suitable part of the pressure member alternatively may be fixed. In this latter case the pressure member may be formed in such a way that it will be locked in the hole chosen where it is engaged with pressure against the sole of the shoe.

It is of course also possible to arrange special locking means which are adapted to lock the pressing member in the hole where it is engaged.

The use of a number of alternative holes in the side of the toe iron of the ski binding is very simple and inexpensive and is at this time by the inventor considered as preferable, especially there where the invention is adapted to be used in combination with that type of bindings where the pressure member is formed as longitudinally swingable levers, one on each side of the binding and preferably fixed together to form a U-shaped pressure member.

With reference to the drawing an embodiment for the invention of the type just mentioned will be described.

In the drawing **1** denotes the longitudinal cross section through the middle part of a ski, on this the angle formed toe piece **2** for the binding is attached. In the upright member of the toe piece two holes **3** and **4** are arranged, and both of these are adapted alternatively to receive the free end of the pressing member **5**. The pressure member **5** may have a head **6** which is formed in such a way that the pressure member can not be taken out when first in place through one of the holes **3** or **4**.

In order to be able to introduce the head **6** of the pressure member through the holes **3** and **4** it is practical to make the holes in one of the side irons oblong and to arrange a detachable locking member over the lower part of the holes.

By changing the pressure member from the hole **4** to the hole **3**, the pressure which the member will exert against the sole of the shoe when in place will be moved towards the rear of the shoe.

BROR WITH.

[illegible]

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

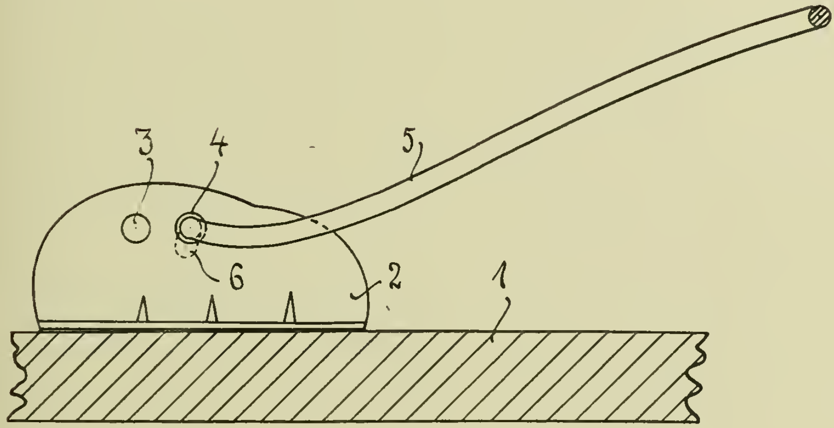
B. WITH

MEANS FOR FASTENING SHOES OR SKIS

Filed June 14, 1940

Serial No.

340,606



Inventor,
Bror With

By: Glascock Downing & Seebold
Attys.

Published June 8, 1943

Serial No. 342,569

ALIEN PROPERTY CUSTODIAN

ELECTRIC CIRCUIT BREAKERS

Charles Bresson, Lyon, France; vested in the Alien Property Custodian

Application filed June 26, 1940

This invention relates to electric circuit breakers, and more particularly to apparatus for ultra rapidly reclosing the arc-drawing means following their separation responsive to the occurrence of a fault in the electric system to be protected.

One of the objects of the invention is to reduce the amount of energy required for such reclosing of the arc drawing means.

Another object of the invention is to provide apparatus for reclosing the arc-drawing means in electric circuit breakers, which comprises means for storing up potential energy, for example, by slowing up movable parts of the circuit breaker during the separation of the arc-drawing means, and redelivering the energy thus stored up as additional energy for the reclosing of said arc-drawing means, the energy thus stored up being that resulting from the kinetic energy of said movable parts.

The invention, the aforesaid objects thereof, and such other aims and objects as may hereinafter appear, will be readily understood from the following description, taken in connection with the accompanying drawing of one embodiment of the invention herein given for illustrative purposes, the true scope of the invention being more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is an elevation of a monophase element of a circuit breaker mounted upon a carriage;

Fig. 2 in its upper portion shows, partly in elevation, partly in section, a circuit breaker B, and in its lower portion a plan view of the controlling or operating mechanism of the arc-drawing means and a diagram of the electric plant for operating the two apparatus A and B:

Figs. 3 and 4 show details.

The invention is herein shown in its application to a polyphase circuit breaker plant, but it will be understood that it is not to be considered as limited to this particular application. Said polyphase circuit breaker plant (see Fig. 1) herein comprises a normal or main circuit breaker A having connected in series therewith an ultra-rapid circuit breaker B, which, upon the occurrence of a fault, acts immediately to break the circuit of the electric system to be protected, but only in that phase affected by said fault, and then recloses said circuit before said normal circuit breaker A of slow or delayed operation has had time to operate, said normal circuit breaker operating definitively to break said circuit only should the fault persist.

Suitable means are provided, such as a swinging member S, to connect or disconnect said two circuit breakers A and B; and each pole of said circuit breaker B is separately controlled or operated. The arc-drawing means comprises a fixed and a movable contact, the latter consisting of a rod C which passes through an arc-drawing chamber D and is actuated by suitable means herein comprising a lever L_1, fulcrumed at L_2 and pivotally connected by a link B*e* to a member P. The latter is loose upon a shaft T and carries a tooth L_3 adapted to be held forcibly against a pin L_4 upon an actuator E by a spring R_1 which serves to store up potential energy, as will be more fully set forth further on. Said actuator is rigidly connected to a rotary column I provided at its lower end with a crank M*g* carrying a roller at its free end.

The movement to separate the movable contact from the fixed contact is in the direction indicated by the arrow f_1 and is effected by a cam C*a* which is swung in the direction indicated by an arrow f_2 by a spiral spring *s*. This spring is secured at one end to said cam and is tensioned by a worm W driven by a motor M*o* and meshing with a gear *u* to which the other end of said spring is secured. The system is arrested with the arc-drawing contacts in closed position by a lever L*d* which controls the separation of said contacts. A hiatus occurs in the operation between the separation of said contacts and their reclosure to permit de-ionisation of the air at the place where the fault which caused the separation of said contacts occurred. The duration of said hiatus is variable and is determined by a mechanical time lag relay DM which acts upon lever L*r* that controls the closing movement of said movable contact C.

The parts of the apparatus being in the position shown in Fig. 2, with the arc-drawing contacts closed, the operation is as follows:

Upon the occurrence of a fault on the system to be protected, a relay R, which is supplied with energy from a transformer T*i*, operates immediately to close the circuit of the coil of an ultra-rapid acting two point contact CUR. A coil BB is thus energized and its core, acting upon toggle Lc, actuates lever L*d* to release cam C*a*, which starts to rotate and turn crank M*g*. When said cam has completed one revolution, the rotary column I and said movable contact C being still mechanically connected, continue their movement. When the parts are nearing the positions shown in Fig. 3, movement of the system comprising lever L_1 and said movable contact C slows up, while movement of said rotary column I is accelerated. When the member P, in this op-

eration, meets the stop B*t*, operation of the system comprising parts P, B*e*, L_1 and C is arrested; movement of said actuator E and said column I continuing, spring R_1 will be strongly tensioned, thus storing up potential energy derived from the kinetic energy of said column I. When the maximum elongation of said spring R_1 is attained, crank M*g* is locked with lever L*r*, as shown in Fig. 2.

In the course of the above described operation cam C*a*, acting in its rotation at the proper time upon a two point break T*a*, breaks the circuit of said coil BB. Said two point break T*a* is connected to a mechanical relay RM, which is so constructed and arranged that it will not reclose said circuit until a certain time has elapsed after the extinction of the drawn arc, in practice about fifteen seconds, in order to prevent the circuit from being broken twice in rapid succession in the same chamber.

At the start of the circuit breaking movement of said movable contact a nose N sets the above-mentioned time lag relay DM in operation. When the period of time for which said time lag relay is adjusted has elapsed, said relay actuates a striker P*r* to break a toggle pivoted at one end to a fixed point and at the other to said lever L*r*, which controls the reclosing movement of said arc-drawing contact C. This causes said lever L*r* to release crank M*g* and said spring R_1, which latter thus delivers the energy it previously stored up during the circuit breaking movement of said movable contact C. This vigorously draws back said actuator E, integral with said column I, toward said member P, which latter is still pressed against the stop B*t*. When these two parts meet the movement of said contact C is accelerated, the speed of said column I diminishes, and said movable contact closes the circuit, inclosing movement being damped by a conventional hydraulic damper A*h*.

If, when the closing movement of said movable contact is completed, the fault has disappeared, the circuit BD will remain broken by the relay RR, the action of which is sufficiently retarded and which no longer is supplied with current through the ultra-rapid two point contact CUR, and the main circuit breaker A will not operate to break the current. On the other hand, should the fault still persist, relay R and consequently said two point contact CUR will operate automatically to cause relay RR to close circuit BD, thus operating main circuit breaker A definitely to break the circuit.

It will be seen that the present invention enables practically all the energy used for operating the circuit breaker B to break the circuit, to be recuperated on conclusion of said operation, and to utilize the energy thus recuperated to insure the rapid reclosure of said circuit by said circuit breaker B. It is thus possible to use a much less powerful motor, motor Mo for example, than has heretofore been required, and still obtain the same rapidity of reclosure. Thus, by diminishing by one half, for example, the energy to be stored up in spring *s*, the power of motor Mo can be reduced by this same amount while still obtaining a speed of operation comparable to that heretofore obtained with circuit breakers using the more powerful motor without the energy recuperating feature of the present invention.

I am aware that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire that the present embodiment of the invention be considered in all respects as illustrative and not restrictive.

CHARLES BRESSON.

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C. BRESSON
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2 Sheets-Sheet 1

Fig. 1

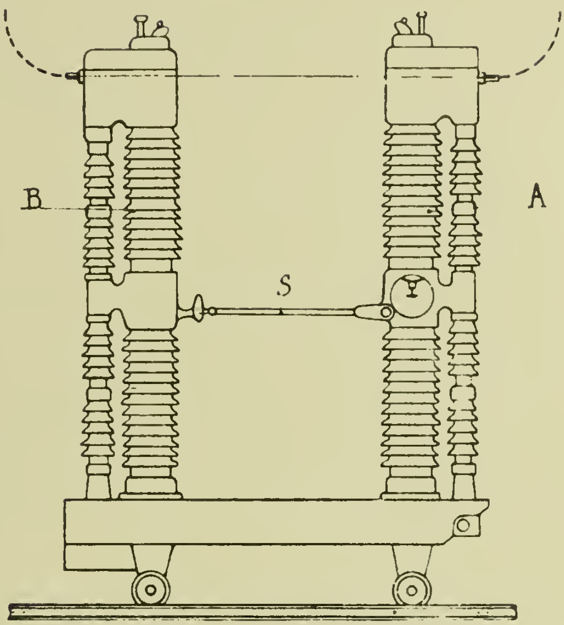


Fig. 3

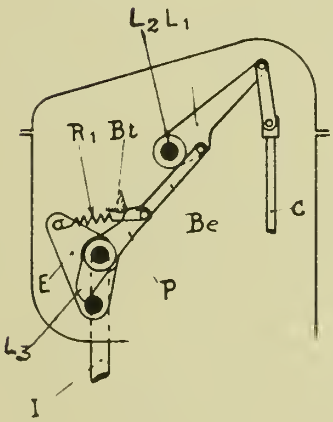
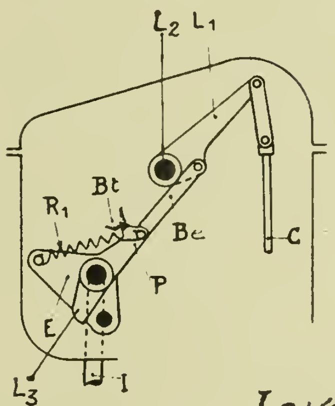


Fig. 4



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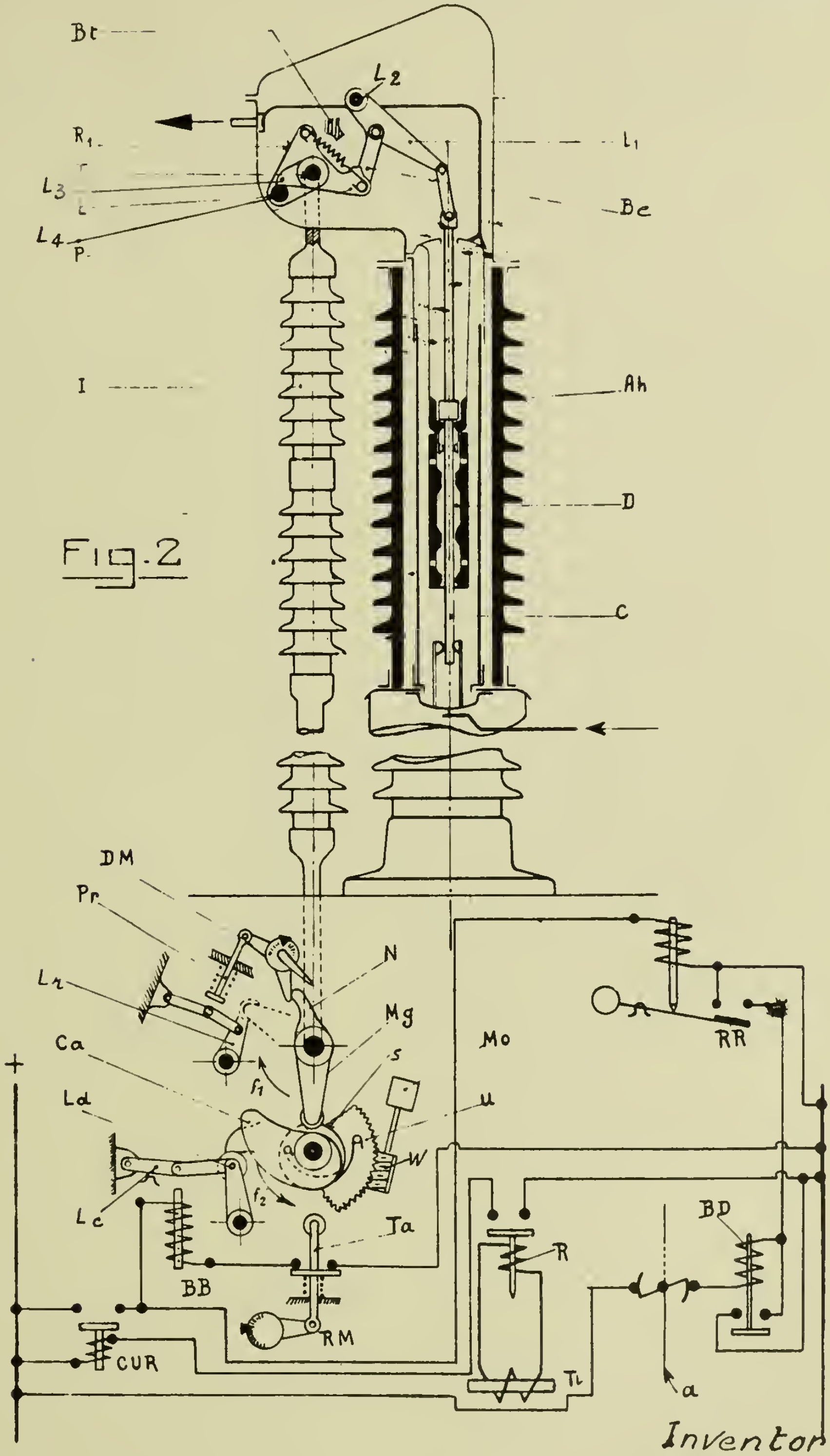

Fig. 2

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ALIEN PROPERTY CUSTODIAN

FLY-WHEEL STARTERS FOR AIRCRAFT ENGINES

Charles Raymond Waseige, Rueil, Seine-et-Oise, France; vested in the Alien Property Custodian

Application filed June 29, 1940

My invention relates to the devices used for starting internal combustion engines for aircrafts and the like and more particularly to those mechanical devices intended to rotate the engine to be started which are known by the name of fly-wheel starters, and also to electric devices for producing the ignition during starting, and has for its objects a number of improvements in this type of devices, which improvements may be used together or separately.

It is known that such starters essentially comprise an electric or other motor which enables a high speed to be imparted to a fly-wheel which is connected by a mechanism including a high ratio reducing gear to a claw that a control enables to be coupled to the engine to be started when said fly-wheel has accumulated sufficient energy.

A first improvement in starters consists in that, in combination with a torque limiting device interposed in the transmission from the fly-wheel to the coupling claw for the engine to be started, there exists a resilient metal device which is adapted to be tensioned progressively by the action of a momentary difference in speed between two members of the said transmission which are connected to each other without reducing gearing by means which enable them to effect an angular displacement relatively to each other, the degree of tension of said resilient device determining the driving torque applied to the said coupling claw and said torque limiting device being in this case adapted only to slip in the event of there being an abnormally high resisting torque.

This combination of means has the advantage of preventing slipping of the torque limiting device when the starter is coupled to the engine to be started, slipping only occurring for a resisting torque which is much greater than the torque required to start the rotation of the engine crankshaft, that is to say in case of abnormal resistance or of back-firing in the engine; furthermore, the driving torque of the coupling claw increases very gradually from a small or zero value up to that required for rotating the crankshaft.

In a preferred embodiment, the transmission mechanism comprises two rotary members which are rotatable about the same axis while being stationary with respect to said axis in a direction parallel thereto and one of which is driven by the fly-wheel of the starter and the other is rotatable integral with the coupling claw for the engine, and the transmission between said two rotary members is ensured by a movable member which is slidable parallel to said shaft and is connected, for this purpose, to said two rotary members respectively by means of slidable keying means, at least one of which is formed by reversible ramps, helical or the like, said movable member being subjected to the action of a resilient device which urges it parallel to said axis in the opposite direction to the movement it effects under the action of said ramps when the aforesaid driven rotary member rotates slower than the driving rotary member.

Advantageously, the driving rotary member is formed by a barrel and the driven member by a coaxial sleeve on which the stem of the coupling claw is slidably keyed; the movable member being provided with splines adapted to cooperate with splines provided on the facing surfaces of the barrel and of the sleeve respectively and being subjected to the action of one or a series of springs lodged in the barrel.

It is advantageous for both the aforesaid splines to be formed by helical ramps so as to increase the angle of displacement between the two members of the resilient coupling.

Another improvement according to my invention relates to starters in which the claw is provided with an axial hole for the passage of a slidable rod terminated by an abutment against which said claw is urged by a resilient means and provided for ensuring the fluid-tightness of said hole so as to prevent any inlet of oil into the case of the starter.

According to one embodiment, said fluid-tightness is ensured by means of a ring made of plastic material of U-shaped cross-section, which is inserted in said hole and the two arms of which are radial and are in contact with the two outer and inner faces of the claw, said resilient means including a spring which bears against said ring and keeps it compressed.

According to another embodiment, a fluid-tight plug is fitted in the centre of the outer face of the claw and is provided with an inner chamber which enables said rod and its abutment to effect their movements when the claw is sliding.

Another of said improvements consists in that, the apparatus being of the type which includes a coupling claw adapted to be actuated by a barrel which is rotated, through an epicyclic reducer train and a torque limiting device operating by friction, by a fly-wheel driven at high speed, said torque limiting device is interposed between the case of the reducer and a normally stationary sun-wheel of said epicyclic train, the

slipping in case of overload being thus effected between said wheel and the case.

This arrangement enables the diameter of the discs of the torque limiting device to be considerably increased and consequently the number or the pressure of the springs to be decreased.

A still further improvement consists in the fact that a device for adjusting a torque limiting device interposed in the transmission between the fly-wheel and the coupling claw for the engine is accessible from the outside.

Another improvement is that the electric motor for actuating the fly-wheel is a moderate speed one of the order of eight to ten thousand revolutions per minute and gearing up means are interposed between said motor and said fy-wheel, the whole gearing up means being preferably secured to said motor and being removable as a unit with same. It is thus possible:

(1) To use an electric motor having a higher efficiency than that of very high speed electric motors,

(2) To increase the speed of the fly-wheel to be started and thus decrease its weight.

Another improvement which is also an object of the invention relates to the electric apparatus used for starting an aircraft engine. This improvement consists in a switch provided with two contacts which are connected to the frame and respectively co-operate with two movable contacts, one connected to one of the magnetos of the engine to be started and the other to the second magneto, and at least a third fixed contact which is likewise connected to the frame and cooperates with a third movable contact connected to the auxiliary starting generator.

In the case in which said generator is a coil, the switch is provided with a fourth fixed contact which is identical to the third and which cooperates with a fourth movable contact, these two movable contacts being adapted to occupy three positions and to contact respectively with two other fixed contacts connected to the two poles of the source of current.

Other improvements will furthermore become apparent from the ensuing description of an exemplary embodiment of an electric starter provided with all the aforesaid improvements and of apparatus for the ignition during starting.

Said exemplary embodiment is shown in longitudinal section in Fig. 1 of the accompanying drawings:

Fig. 2 is a partial section along the line II—II of Fig. 1;

Fig. 3 shows a modification of construction of a detail; and

Fig. 4 a modification of another detail;

Fig. 5 reproduces in perspective the front part of Fig. 1, slightly modified;

Figs. 6 and 7 are partial views showing modifications of Fig. 1.

Fig. 8 is a detail.

Fig. 9 shows diagrammatically an apparatus for the ignition during starting, including a starting magneto.

Figs. 10 and 11 show the controlling switch in two other operative positions.

Figs. 12, 13 and 14 are respectively similar to Figs. 9, 10 and 11 in the case of apparatus provided with a starting coil.

The starter shown includes, like all fly-wheel starters, a fly-wheel 1. Said fly-wheel 1 is bolted on a plate 2 secured to a hollow elongated hub 3 supported near said plate by a bearing 4 carried by a plate 5 fixed on the end of a cylindrical box 6 carried by a partition 7 inside the case of the apparatus. Said plate 2 carries, on the opposite side to that on which is located the fly-wheel 1, a plurality of shafts 8 which are angularly distributed about the hub 3 and on which are respectively mounted pinions 9 meshing on the one hand with a common pinion 10 secured to the hub 3, and on the other hand with an internally toothed pinion 11, the hub 12 of which is loosely mounted on the hub 3 of the fly-wheel. Beside said hub 12 the hub 3 carries, likewise loosely mounted, the hub 14 of a planet wheel carrier plate 15 on which are mounted a plurality of pinions 17 meshing with a sun-wheel 18 secured to the hub 12 and with a sun-wheel 19 carried by a sleeve 20 centred in the box 6 and provided with an external collar 21 fixed on the end of the box 6 opposite that carrying the plate 5. Said sleeve 20 carries a second sun-wheel 23 with which mesh planet wheels 24 mounted on a planet wheel carrier plate 25, the hub 26 of which is likewise loosely mounted on the hub 3. The planet gears 24 mesh on the other hand with a sun-wheel 28 secured to the hub 14. A pinion 29 is secured to the hub 26 and meshes with a plurality of pinions 30 carried by shafts 31 fixed to the end of a rotary barrel 32 centred by means of ball bearings 33 in a bearing surface 34 of the case. At the centre of the end of said barrel 32 is lodged a ball bearing 35 which acts as a bearing for the end of the hub 3. Said pinions 30 mesh with a sun-wheel 36 which carries on the outside thereof splines on which are fitted the annular discs of a torque limiting device of the usual friction type, the springs 38 of which press all said discs against a plate 39 which is fixed to the case and which centres the wheel 36 by means of a smooth bearing surface provided in the latter. Each of the springs 38 has one of its ends fitted in a cup 40 secured to fingers 41 which pass through the wall of the case and project outside same where all said fingers are in contact with a plate 42 adapted to screw on a screw-thread 43 provided on the outside of the cylindrical bearing surface 34.

The inner face of the cylindrical part of the barrel 32 is provided with helical ramps with a reversible pitch 45 engaging with corresponding ramps 46 provided on the cylindrical periphery of movable piece having the form of a cup 47 and provided at its centre with a hole in the wall of which are formed splines 48 which may be formed by helical ramps and engaged with corresponding splines or ramps 49 of a sleeve 50 coaxial with the barrel and centered at its end on a cylindrical bearing surface 51 projecting from the end of the barrel 32. At its other end, the sleeve 50 carries a plate 52, a strong spring coaxial with the barrel or a series of springs 53 in ring formation are arranged inside the barrel 32 between the cup 47 and said plate 52. A retaining ring 54, which a splined fit in the barrel 32 secures to the latter, holds the sleeve 50 axially, being itself retained longitudinally by means of a nut 55 screwed on the end of the barrel 32.

On the inside of the bore of said sleeve 50 are formed splines 58 which fit into longitudinal splines cut on the stem 60 of the coupling claw 61 for the engine to be started, it being thus possible for said claw to slide longitudinally relatively to the sleeve 50. This possible movement is limited by two shoulders 62 and 63 which respectively abut at the end of the splines 58 and at the end of the sleeve 50. Said stem 60 is provided on the opposite side to the claw 61 with

an axial recess 64 in which is lodged a spring 65 interposed between the bottom of said recess and a shoulder 66 of a long rod 67 lodged in the axis of the hollow hub 3 and the stem 60, through both of which it passes freely from end to end as well as the bottom of said recess 64. It can also slide longitudinally and a nut 68 is screwed on its end and projects outside in the axis of the claw 61, said nut thus forming an abutment against the body of said claw for limiting the axial movement of the rod under the pressure of the spring 65. The opposite end of the central rod 67 is attached to one of the arms of an equalizing lever 70 which is carried by a fixed spindle 71 inside the case and the other arm of which is engaged by a slidable rod 72 projecting outside the case.

The end of the hub 3 nearest the fly-wheel 1 is secured to a pinion 75 which meshes with a wheel 76 of larger diameter which is loosely mounted on the shaft 77 of a moderate speed electric motor 78, of the order of eight to ten thousand revolutions for example. Said wheel 76 furthermore has a rim 79 inside which is arranged a plate 80, the hub of which is keyed on the shaft 77. A shaft 81 fixed on the plate 80, near the periphery thereof, passes through a radially ovalized eye 82 at the end of a resilient circular jaw 83. The latter is centred at three points on the plate in such a manner that in the inoperative position there is a clearance between said jaw 83 and the rim 79 which surrounds it, but under the action of centrifugal force the jaw opens resiliently and rubs against said rim 79, thereby ensuring the drive of the wheel 76. The clutch is constructed so as to be self-tightening but not self-locking. It thus has a variable driving capacity, at the same speed, according to whether the one or the other of its parts is the driving part and the other the resisting part. The whole gearing-up arrangement 76—83 is adapted to be able to pass through the orifice of the case in which fits the end of the motor 78 and can thus be removed and placed in position as an integral unit with said motor, the case of which carries a flange 85 for fixing on the edges of said orifice.

On the end of the barrel 32 there is furthermore fixed a gear 86 which is concentric with the barrel and which meshes with a wheel 87 fast on a shaft 88 which is journalled in the case and which projects outside same by means of a head 89 adapted to receive a crank handle or other manually actuable member.

The operation is as follows:

When the electric motor 78 is started, the centrifugal friction clutch 79—83 is not engaged, so that the motor starts unloaded and the current taken is comparatively small; the shaft 77 of the motor drives the plate 80 at increasing speed; the jaw 83 then gradually opens under the action of the increasing centrifugal force and rubs against the rim 79 when the motor is rotating at a predetermined speed, thereby ensuring the drive of the wheel 76 and of the fly-wheel 1 through the gearing-up mechanism 78—75. This rotation of the fly-wheel 1 is transmitted to the barrel 32 by means of the reducing pinions 10, 9 and 11 and of the epicyclic reducing trains 18, 17, 19, 28, 24, 23 and 29, 30, 35, the sun-wheel 36 being held stationary by the friction device 37 to 40. As nothing prevents the rotation of the claw 61 and of the sleeve 50 which is secured thereto, the cup 47 which rotates integral with the sleeve 50 is rotated by the helical ramps 45 without tending to screw into the barrel 32.

When the fly-wheel 1 has received sufficient impetus, the rod 72 is pulled, which is effected in this case by means of an electromagnet 90 which is energized at the selected instant; the rod 66 is then pushed in the direction *f* and tends to compress the spring 65 which in turn pushes back the claw 61 and brings it into engagement with that of the engine.

As soon as the two claws engage, the claw 61 is brought to a standstill and a relative rotation then exists between the sleeve 50 and the barrel 32, which results in an axial movement of the cup 47 against the action of the springs 53 which it gradually compresses until the torque transmitted by said cup to the claw 61, which torque depends on the tension of said springs, is sufficient to set in rotation the crankshaft of the engine to be started. As soon as the engine starts to rotate under its own power, the starting claw pushes back the claw 61 which returns to the position of Fig. 1, against spring 65, while the springs 53 contract and return the cup 47 to its inoperative position.

In the event of there being an abnormally high but limited resisting torque, slipping of the friction device 37 to 40 occurs and consequently a corresponding rotation of the sun-wheel 36. The value of the maximum torque which said limiting device 39—40 enables to transmit can be readily controlled, without its being necessary to remove the apparatus, by simply manipulating the nut 42 which is outside the apparatus.

On the other hand, the clutch 83—79 is so constructed that, when the resisting torque becomes abnormally high and produces a slowing down of the fly-wheel and of the electric motor 78, its driving torque is less than that of the motor at a speed for which the back electromotive force of the motor is sufficient to limit the intensity of the current of the motor to a value than can be permanently supported by the windings. Slipping then occurs of the jaw 83 relatively to the rim 79 and the automatic release of the clutch thus obtained enables the current to be left on the electric motor 78 without danger of a short-circuit, since said motor can thus continue to rotate at a fair speed while the speed of the fly-wheel continues to decrease.

In the event of failure of the electric motor, the fly-wheel 1 may be started by hand by means of the shaft 88 which enables the barrel 32, and consequently the fly-wheel, to be rotated through the reducing transmission between the fly-wheel and the barrel, which transmission in this case operates with a gear up ratio.

It will be observed that said transmission has a considerable ratio for a very reduced bulk and weight.

Fig. 3 shows a modification of construction of the device for adjusting the torque limiting device 37 to 40. In this modification, the cup 40 for seating the springs 38 is pressed against a screw-threaded part 92 which screws in the case and carries teeth 93 with which engages a pinion 94 carried by a shaft 95 which projects from the case. It is obvious that by rotating said shaft 95, the screw-threaded part 92 is screwed more or less into the case thereby adjusting the springs.

In the modification of Fig. 4, the centrifugal clutch with a self-tightening resilient jaw is replaced by the combination with a free-wheel 96 of a centrifugal clutch, the driving capacity of which is identical in both directions of rotation, said clutch being provided with masses 97 which are movable radially in a cage 98 so as to engage

the rim **79** under the action of centrifugal force, said cage **98** being carried by the shaft **77** by means of said free-wheel **96**. When the electric motor is started the clutch **79—97** is not engaged and the shaft **77** only drives the cage **98** through the free-wheel **96**; it therefore starts with practically no load; when it has been started, the masses **97** rub against the rim **79** and ensure the drive of the wheel **76** and of the whole of the mechanism the latter actuates. The free-wheel **96** enables said wheel **76** to rotate faster than the shaft **77** so that if the supply current of the electric motor is cut off, the latter will not be rotated by the flywheel and will not exert braking action thereon. Fig. 5 reproduces in perspective the front part of Fig. 1, the springs **53** being replaced by a single spring coaxial with the claw **53**[a]. Fig. 6 shows a means for preventing the oil from the engine or the like from penetrating into the case of the starter through the passage **69** provided in the claw **61** for the rod **67** which is provided with an abutment **68** against which the sleeve is pressed by the spring **64**. Said means consists in a ring **99** made of plastic material, the cross-section of which is U-shaped, the two lips of the U respectively bearing against the front and rear transverse faces of the claw **61**. Said ring may be made in two parts, as shown, and on it bears the spring **64** by means of a washer **100**. Under these conditions, the material of said ring is compressed and presses intimately against the walls of the passage **69** and against the rod **67**.

As shown in the modification of Fig. 7, the same result could be obtained simply by means of a screw-threaded plug **102** adapted to close a central recess of the claw **61**, fluid-tightness being ensured by means of two rings **103** and **104**.

Said plug is provided with an inner chamber **105** of sufficient depth to enable the abutment **68** of the road **67** to effect its movement.

Finally, Fig. 8 shows a modification of the manual starting device, according to which the shaft **88** is enclosed in the case and is connected by a single pair of gears **106—107** to a shaft **108** which is arranged perpendicular to the axis of the claw and is provided with a very accessible head **89** which is intended to receive a removable crank handle or the like. The manual starting can thus be effected under the best conditions.

In Fig. 9, which shows diagrammatically the electric apparatus for the ignition during starting, **201** designates the magneto for normal operation and **202** the starting contact with which said magneto is provided, **203** designates one of the spark plugs and **204** the metal mass of the engine; **205** is the starting magneto, the secondary of which is connected by a wire **206** to the starting contact **202** of the normal operation magneto **201**, whereas its primary is connected by a wire **207** to a movable contact **208** of a switch **209**. Said contact **208** co-operates with a contact **210** and the switch is provided with two other contacts **211** and **212** which are connected to the frame **204** and co-operate respectively with movable contacts **213** and **214** respectively connected by the wires **215** and **216** to the normal operation magnetos of the engine.

The operation of this apparatus is as follows:

In the inoperative position (Fig. 10) the three movable contacts **208**, **213** and **214** are respectively connected to the corresponding contacts **209**, **211** and **212** and the respective primaries of the three magnetos are connected to the frame. The ignition is cut off and there is absolute safety.

In order to start the engine, (Fig. 11), the movable contacts **208**, **213** and **214** are separated from the contacts **209**, **211** and **212** and the primaries of the three magnetos are insulated from the frame. The three magnetos can therefore all supply current at once.

In normal operation (Fig. 9), the movable contacts **213** and **214** are separated from the contacts **211** and **212** but the movable contact **208** is on the contact **209**. The normal operation magnetos therefore continue to supply current whereas the starting magneto **205** no longer supplies current, its primary being connected to the frame and the high frequency oscillations being short-circuited to the frame.

The apparatus shown in Fig. 12 differs from the previous one by the fact that the high tension starting generator is formed by a coil **205*a***. One of the ends of the primary of said coil is connected to the movable contact **208** as was the above starting magneto **205** but the switch is provided with a contact **218** which co-operates with said movable contact **208** and which is connected by a conductor **219** to one of the poles of a source of current **220**. The other end of said primary is connected to a shielded switch **221** which is itself connected to a movable contact **208*a*** of the switch, which contact is similar to the contact **208**, and which co-operates with two contacts **210*a*** and **218** respectively connected to the contact **212** and, through a conductor **222**, to the second pole of said source of current.

The operation is the same as in the previous case and it is obvious (Fig. 12) that in normal operation, the coil **205*a*** is completely insulated from the source of current **220** while the normal operation magnetos are connected to the frame through the coil **205** owing to the fact that the movable contacts **208** and **208*a*** are connected to the contacts **210** and **210*a***.

When inoperative, (Fig. 13) the normal operation magnetos are directly connected to the frame, the movable contacts **213** and **214** being respectively connected to the contacts **211** and **212** and the coil is again completely insulated from the source of current **220**, the contacts **208** and **208*a*** being open.

In the position for starting ignition (Fig. 13), the contacts **108** and **108*a*** are connected to the contacts **118** and **113*a*** and the coil **105*a*** is thus connected to the source of current **120**, whereas the contacts **113** and **114** are open and the corresponding magnetos are insulated from the frame.

Whether the starting high tension generator is a magneto or a coil, the movable contacts of the switch are preferably conjugated with each other in such a manner as to be operable by means of a common hand or foot operated member.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification, without departing from the spirit of the invention.

CHARLES RAYMOND WASEIGE.

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FLY-WHEEL STARTERS FOR AIRCRAFT ENGINES

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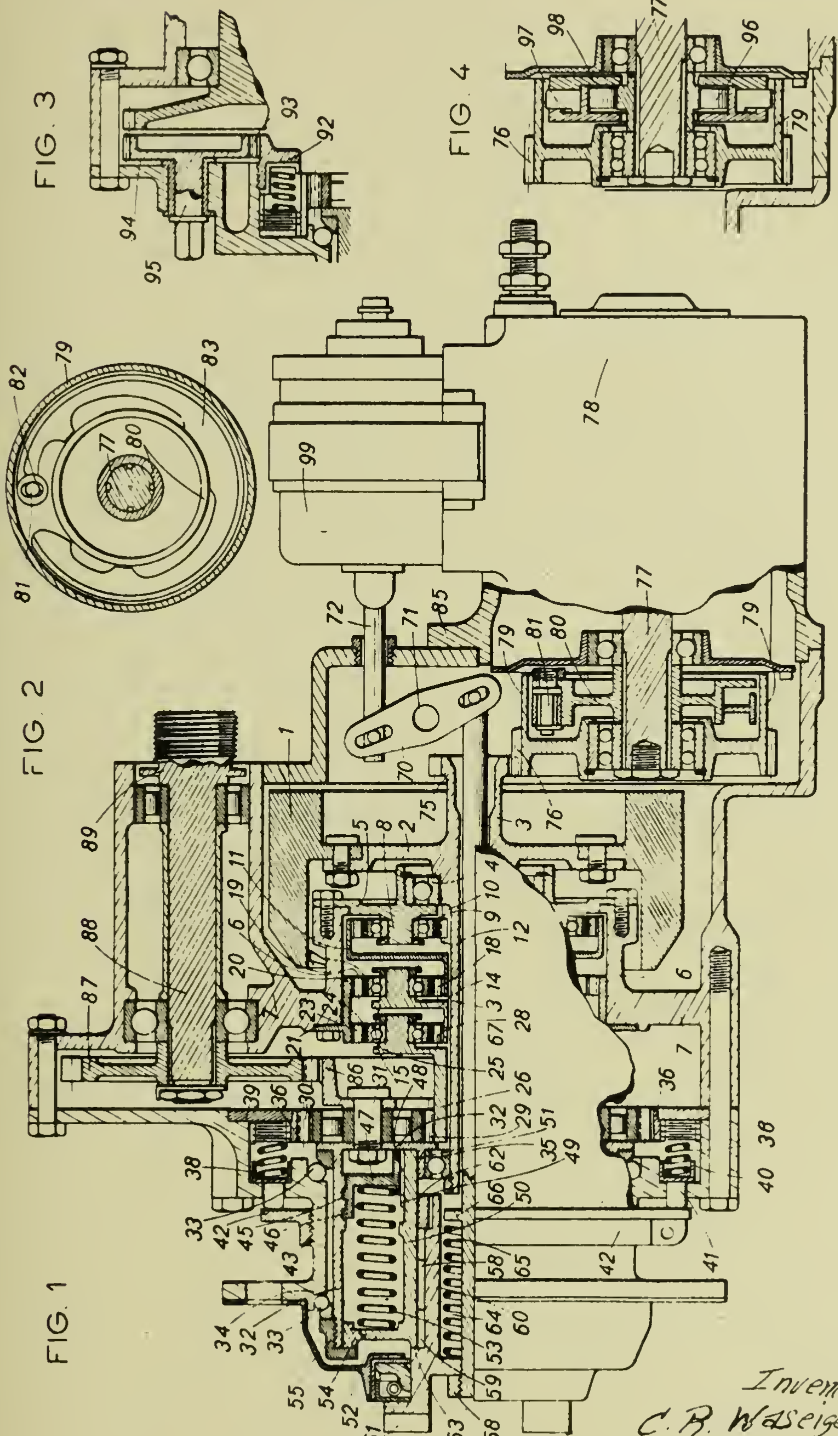
3 Sheets-Sheet 1



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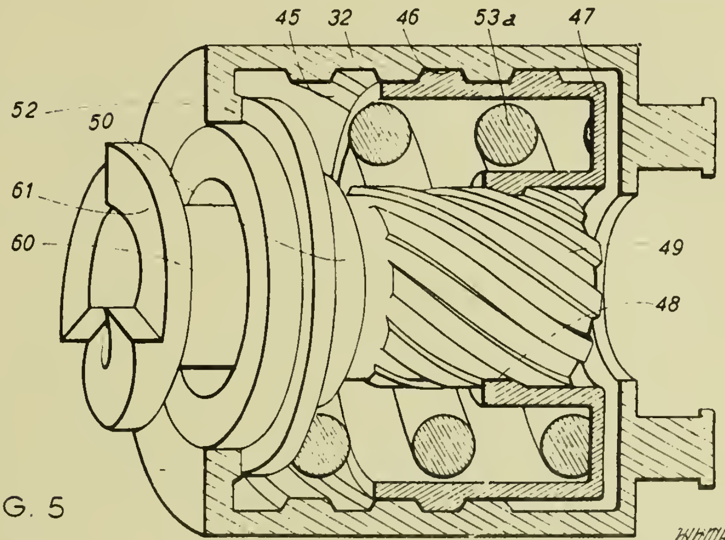

FIG. 5

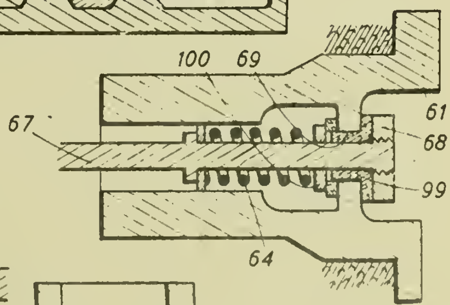

FIG 6

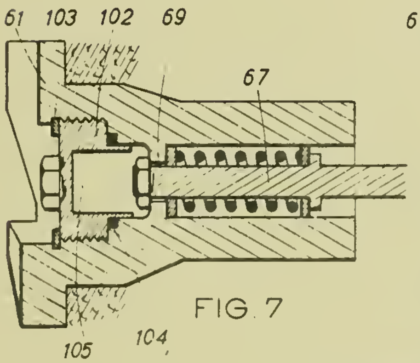

FIG. 7

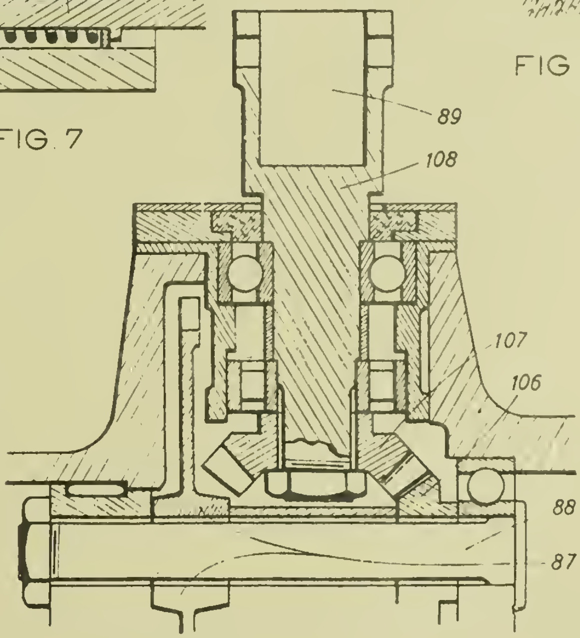

FIG. 8

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FIG. 9

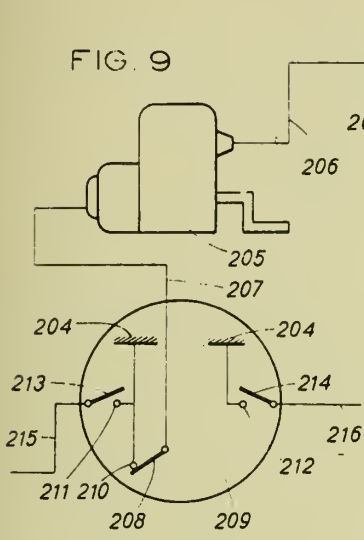


FIG 10

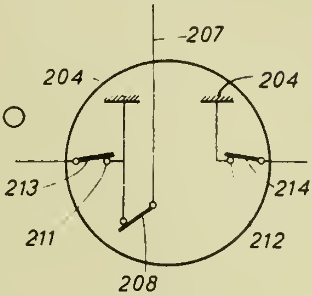


FIG 11

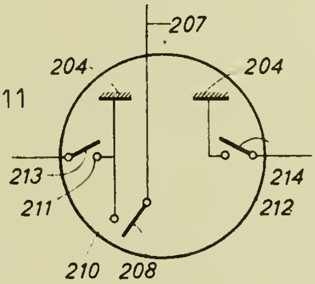


FIG. 12

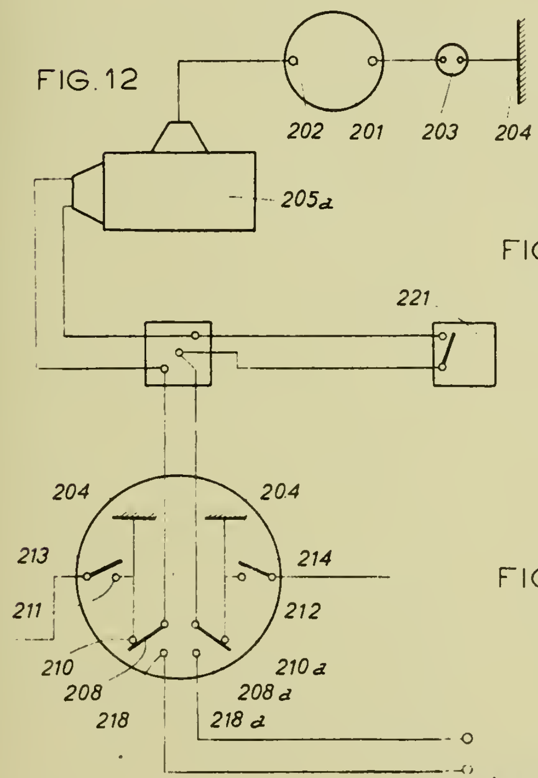


FIG 13

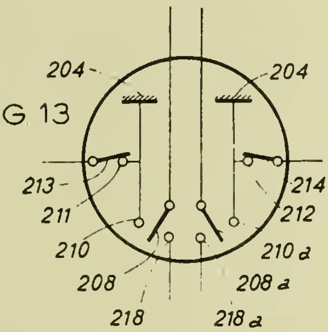
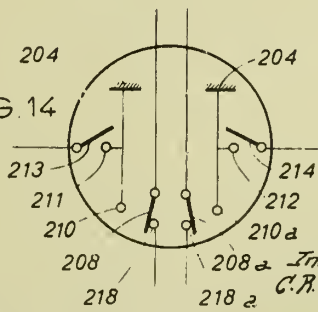


FIG. 14



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ALIEN PROPERTY CUSTODIAN

SLUICING DEVICES FOR CORPUSCULAR RAY APPARATUS

Franz Weigend, Berlin-Spandau, Germany; vested in the Alien Property Custodian

Application filed July 30, 1940

This invention relates to sluicing devices for corpuscular ray apparatus.

When operating corpuscular ray apparatus (oscillographs), particularly an electronic microscope, it is necessary to bring the bodies, for instance, the objects to be tested and diaphragms as well into and out of the vacuum chamber without impairing the vacuum. To introduce such objects into the vacuum chamber it has hitherto been usual to provide a cock in a cock casing extending through the apparatus. The cock plug is provided with a bore serving as a sluicing chamber and through which passes the ray, said bore enabling a communication with a bore of the cock casing extending outwardly as well as with the vacuum chamber. The prior sluicing device does not lend itself readily to such electronic microscopes which serve for the observation of surfaces.

The invention relates to a sluicing device for corpuscular ray apparatus whose construction differs from that described above in such manner as to be suitable for electronic microscopes of the last-mentioned type. Further, the invention relates to novel driving means which serve to bring the objects introduced into the sluicing chamber, such as, for instance, the object cartridge into the desired operating position after the sluicing chamber has been brought into communication with the vacuum chamber.

This improvement is also suitable for microscopes in which the rays pass through the object.

According to the invention a bore provided in the cock plug and closed at one end serves as a sluicing chamber. The object, for instance, the object cartridge is introduced into this bore and brought into the operating position by rotating the cock. In this sluicing device the electron rays do not pass through the bore for the reception of the cartridge as is the case with the prior sluicing device mentioned above. The cartridge according to the invention may be brought into such an operating position with the aid of simple means by moving it out of the bore that the electron rays entering the microscope substantially perpendicularly to its axis strike the object and are reflected by the latter into the optical system serving to magnify the object.

The sluicing device is preferably so designed that after the insertion of the object cartridge the cock plug may be brought into the position in which the sluicing chamber communicates with the vacuum chamber by rotating it 180°. To bring the object cartridge from this position into the operating position a drive serving to move the object cartridge out of the bore is preferably employed according to the invention which is arranged in the cock plug and is actuated exteriorly of the vacuum chamber. To this end, the object cartridge may be inserted in a sleeve which in turn is slidably arranged in the bore closed at one end. The sleeve itself is actuated according to the invention preferably through a shaft provided with a sealing cone. In order to ensure an adjustment of the object cartridge in both directions of movement it is preferable to effect a drive with the aid of gears and gear racks. A particularly simple device easy to operate may, for instance, be obtained if the driving device for moving the object cartridge into the cock of the sluicing device is so arranged that the axis of the driving shaft coincides with the axis of the cock plug. In this case the object cartridge may be actuated from one point.

The above-described drive for the object cartridge is also of advantage if the sluicing device is designed in such a manner that the electron ray passes in the operating position through the bore for the reception of the object cartridge, for also in this case the object cartridge may be raised and lowered without causing a jamming of the object cartridge in the water-cooled guide sleeve. A better exchange of heat is thus obtained, since the object cartridge may be brought nearer to the heat exchange surfaces than has hitherto been possible.

In the accompanying drawings is shown as an embodiment of the invention a sluicing device for an electronic microscope serving to observe surfaces of objects.

Fig. 1 is a cross-sectional view of the sluicing device;

Fig. 2 is a side elevational view thereof;

Fig. 3 is a sectional view on the line A—B of Fig. 1;

Figs. 4 and 5 are two longitudinal sectional views of the sluice cock with its inner parts, and

Fig. 6 is a cross-sectional view taken along the line C—D of Fig. 5.

Referring to the drawings, **1** denotes the casing enclosing the object sluicing device and which forms a part of the vacuum wall. In this casing is fitted the part **2** provided with a sealing cone and to which is secured the cathode (not shown) of the electronic microscope. The casing **1** is arranged on the objective lens **3** of the electronic microscope. The axis of this lens is perpendicular to the axis of the part **2**. The lower end **4** of the objective lens is provided with a sealing cone **5** which fits in a corresponding wall

portion (not shown) of the electronic microscope. The electron ray passes through the part 2 in the direction as indicated by the arrow 8 and is reflected by the object 6 supported in the object cartridge 7, so that it enters the objective in the direction as indicated by the arrow 9.

A sluicing device provided with a cock plug 10 serves to sluice the object cartridge 7. The plug 10 may be rotated with the aid of a hand wheel 11 and is firmly held in position by a spring 12. In the plug is provided a bore 13 (Figs. 4, 5, 6) in which is arranged a sleeve 14 to which the cartridge 7 is threadedly attached. The sleeve 14 is so mounted in the bore 13 as to move in the upward and downward direction. To this end, the sleeve 14 is provided with a gearing 15 in the form of a toothed rack cooperating with a gear 16. The gear 16 is mounted on a shaft 17 arranged in the cock in parallel relation to the axis of the plug 10 and mounted in the two ball bearing 18, 19. On the left-hand end of the shaft 17 is mounted a gear 20 meshing with a second gear 21 which in turn may be rotated by means of a driving shaft 22 to be actuated exteriorly of the vacuum chamber. The adjustment is effected by the hand wheel 23. To seal the driving shaft 22, the sealing cone 24 is employed which is integral with the shaft 22.

To insert an object cartridge, the cock 10 is so adjusted by means of a hand-operated wheel 11 that the bore 13 is opposite to the opening 25 for introducing the object into the sleeve, so that the axis of the bore 13 coincides with the axis of the opening 25. In this operating position the cartridge 7 is screwed on the sleeve 14. The cartridge 7 is then within the bore 13 so that the cock 10 may be rotated by 180° to bring it into the position shown in Fig. 1, in which the axis of the bore 13 coincides with the axis of the objective 3. The object cartridge 7 is moved out of the bore 13 in the downward direction together with the sleeve 14 by rotating the hand-operated wheel 23 until it assumes the operating position shown in Fig. 1.

26 and 27 denote cooling ducts through which flows cooling water during the operation. 28 denotes the corresponding cooling water conduit. The arrangement is preferably so designed that the object cartridge may be shifted within the sleeve in parallel relation to its axis in order to compensate for the changes in position of the cartridges, due to the wear of the plug.

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Fig. 1

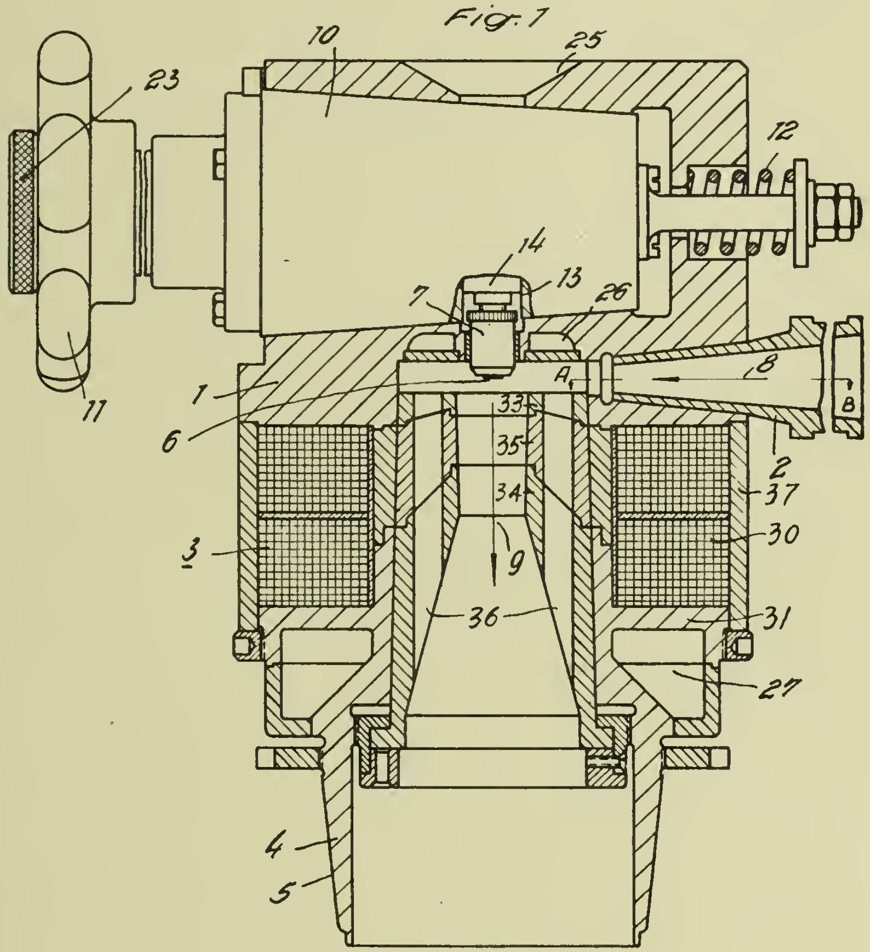

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Fig. 2

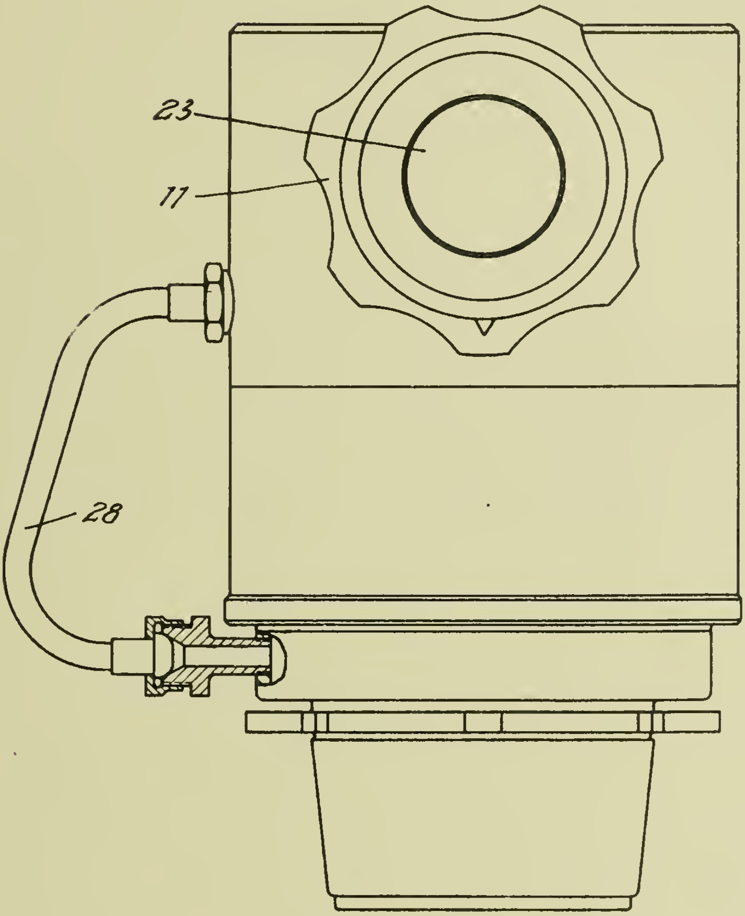

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Fig. 3

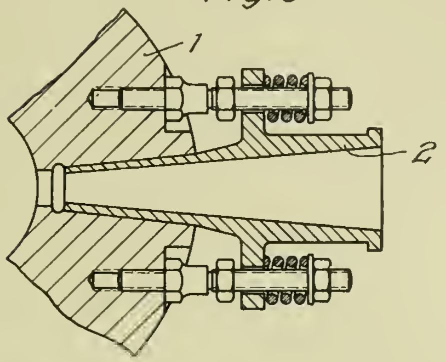


Fig. 4

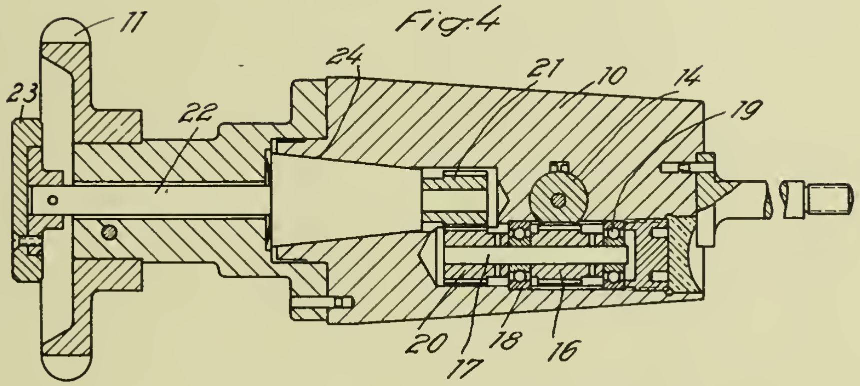


Fig. 5

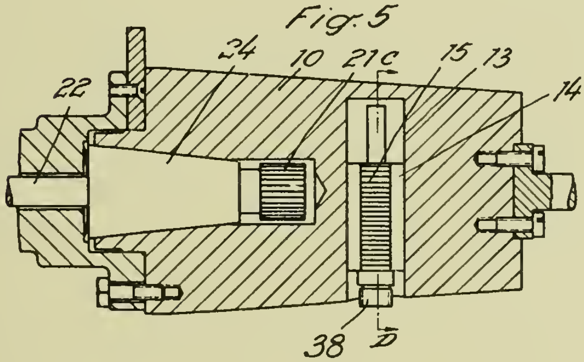
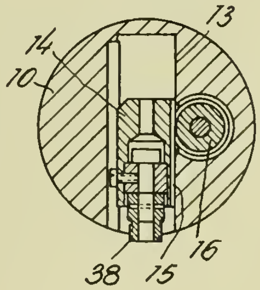


Fig 6



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Published June 8, 1943

Serial No. 352,165

ALIEN PROPERTY CUSTODIAN

CASTING APPARATUS FOR USE IN MACHINES FOR CASTING CHOCOLATE AND THE LIKE

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Application filed August 10, 1940

My invention relates to a casting apparatus for use in machines for casting chocolate and the like.

In a known type of such machines the casting is performed by means of a reciprocating piston working in a stationary cylinder by applying a slide which is controlled exactly in relation to the mould cavities in a row of mould plates which by means of a conveyor belt are moved at a constant speed past the casting head and through a refrigerating chamber of a material extension. Here the difficulty is encountered that in machines in which the conveyor runs at a considerable speed owing to the capacity, a very short time is available only for the casting in each mould cavity, especially when these are arranged in close proximity. On this account it has been proposed to lengthen the time available for the casting by giving the casting head an oscillatory movement, thereby following the conveyor during the casting process. Hereby, however, simultaneously the time period for the suction stroke of the pistons is shortened so that the advantage of such means is limited.

The main object of the present invention is to avoid this drawback and to provide a casting apparatus which is able to operate at a considerable speed and by which the discharge from the apparatus can be exactly timed in accordance with the speed of the conveyor and the arrangement of the mould cavities in the mould plates.

A further object is to provide an apparatus of the kind in question in which the discharge jets can be suddenly broken so that moistening of the mould plates and the conveyor by afterdripping or so-called "tailing" is obviated.

A still further object is to provide an apparatus of the kind mentioned which can readily be adjusted to cast chocolate bodies of various weight and configuration in in accordance with the kind of mould plates arranged on the conveyor.

According to the invention a rotary pump is applied instead of the reciprocating pumps hitherto used. For the object in question it is preferably to use a special embodiment of such pump, as will be described later on.

The invention is illustrated by way of examples in the accompanying drawings, wherein

Fig. 1 shows a casting pump according to my invention in cross-section,

Fig. 2 shows partly a longitudinal section of the same along the line II—II in Fig. 1,

Fig. 3 shows an altered embodiment for an insertion piece shown at the bottom of Fig. 2,

Fig. 4 is, on a reduced scale, a side elevation of a casting apparatus with a pump as shown in Figs. 1 and 2,

Fig. 5 is an end view of the same,

Fig. 6 shows, partly schematically, the drive mechanism of the apparatus of Figs. 4 and 5,

Figs. 7 and 8 show altered embodiments of certain cam discs shown in Fig. 6, used in connection with an altered mode of operation of the apparatus,

Fig. 9 shows part of an arm used in connection with a slightly altered embodiment of the casting pump, as seen from the inner side of the arm,

Fig. 10 shows a longitudinal section of part of said embodiment, the upper part of the rotary body of the pump being not cut through,

Fig. 11 is a perspective view of the pump according to the last named embodiment and, partly schematically, the corresponding drive mechanism.

The pump, shown in Figs. 1 and 2, consists of a casing 10, in the walls of which are found recesses 12 for containing a heating medium serving to keep the mass, e. g. chocolate, contained in the casing in a liquid state. In bores 14 in the end walls of the casing 10 is arranged an annular body 16 which can be driven by a gear wheel 18. At the circumference of the body 16 is found a number of axially spaced rows of radially arranged cylinder bores 20, each occupying a piston 22. The piston rods 24 of these pistons project into the free central space 26 of the body 16, each carrying a roller 28 at the free end. The rollers of all pistons in an axial row may have a common pivot pin 30, as shown in Fig. 2.

One side of the casing 10 forms a tight seal against the annular body 16, see Fig. 1, while at the other side the casing forms a chamber 32 extending along a considerable part of the circumference of the body 16, said chamber serving to occupy the chocolate. The transition to the tightly sealing part of the casing 10 is formed by an inclined face 33 which adjoins the circumference of the body 16 tangentially to prevent jamming of solid particles in the chocolate. At the bottom the last named part of the casing forms, for each circumferential row of cylinder bores 20, a cavity 34 which extends over the open ends of two successive cylinder bores 20, as it appears from Fig. 1. The cavities 34 are closed below by an insertion piece 36 secured removably to the bottom of the casing 10. According to Fig. 2, this piece 36 is so formed that each cavity 34 has its own outlet 38. In the altered embodiment of the insertion piece 36′, shown in Fig. 3, the cavities 34 are united in groups to a single

outlet 38′ which thus is common for more axially successive cylinder bores 20.

For moving the pistons 22 a beam 40 is arranged in axial direction in the central space 26 of the body 16, said beam being supported in a floating manner at its ends on square studs 42, as will be explained later on. On one side of the beam 40 is formed a cam 44, by which the pistons 22 are displaced to the top position as they are moved past the cavities 34, the pistons being normally held in the bottom position by springs 46, one of which only is shown in Fig. 1.

Suitably the cam 44 is so formed that a piston 22 is moved from the bottom position when the free end of the appertaining cylinder bore 20 in its whole width has connection with the appertaining cavity 34 and that this piston is moved from the bottom position to the top position during the time, in which the free end of the cylinder with its whole area has connection with the cavity 34 during the rotation of the body 16. Furthermore the cam 44 is so shaped that the pistons driven by it are moved at a constant speed when the body is turned at a constant speed.

By the pump described a uniform output of the chocolate through the outlets 38 will take place when the body 16 is rotated, and when the body is turned stepwise the required casting in portions of the chocolate will be obtained. For this procedure the length of each step is of no consequence and the pump according to my invention thus has the advantage that the quantity of chocolate to be cast can be determined in a simple manner, viz. solely by the angle of rotation of each casting.

As it appears from Fig. 4 over the casing 10 is arranged a hopper 48 so that the casting apparatus may contain a great quantity of chocolate. The casing 10 is supported by brackets 50 in relation to a stationary frame 52, past which is moved the conveyor belt 54 of the apparatus, carrying mould plates 56 containing mould cavities, vide Fig. 5. In the brackets 50 the drive mechanism of the apparatus is mounted.

The gear wheel 18 arranged on the end of the body 16 intermeshes with a gear wheel 58 at the end of a shaft 60 journalled in the brackets 50. By means of a number of gears 62 with different gearings this shaft is driven from a shaft 64 carrying a pawl wheel 66. As schematically shown in Fig. 6 the pawl wheel 66 is driven by a pawl 68 pivoted on a lever 70 swingable on the shaft 64. This lever is pivotally connected to a push rod 72 the position of which furthermore is determined by it being hinged to a link 74 which at the present may be regarded as swingable on a stationary pin 76. At its free end the push rod 72 carries a roller 78 running on the circumference of a cam disc 80 fixed to a shaft 82. This shaft runs synchronously with the conveyor 54.

It is evident, that when the shaft 82 is driven in the direction indicated by an arrow the cam disc 80 will move the pawl 68 to and fro through the intermedium of the push rod 72 and the lever 70 so that the pawl as a one-way drive will move the pawl wheel 66 step by step whereby in turn the body 16, Figs. 1 and 2, is moved stepwise. If, as shown in Fig. 5, by a clutch 83 is interposed a gear 62 with the gearing ratio 1:1, the body 16 will be advanced one pitch for each movement of the pawl wheel 66. By each casting operation thus a single axial row of the pistons 22 will be active.

As it appears from Figs. 4–6 the beam 40 at its end studs 42 is suspended in two-armed levers 84 swingable on stationary pivots 86. Through the intermedium of suitable joints and nuts these levers by means of screw spindles 88 are connected with another set two-armed levers 90 which with rollers 92 rest on cam discs 94 on the shaft 82. The beam 40 with the cam 44 thus is supported by a link system 84, 88, 90 in such manner that the level of the beam is determined by the cam discs 94.

These latter are so shaped that the beam 40 and thus the cam 44 suddenly will be lifted, that is to say retracted in relation to the pistons 22 with which the cam co-act, at the end of each casting period, the object of this being to obtain a rapid interruption of the casting process. Hereby the speed of the jets passing through the outlets will decrease to zero at the end of the casting period and when the jets are broken at the mouths of the outlets, the surface of the chocolate will be retracted and form a concave surface, as it is indicated in Fig. 1, and thus a perfect and exact breaking of the jet is secured and afterdripping is obviated.

After the sudden lifting the beam 40 must be returned to its original position, which in accordance with the shape of the cam discs 94 is brought about by a slow lowering during the succeeding delivery stroke of the pistons 22 in the next row.

The screw spindles 88 have right hand threads on one half part and left hand threads on the other half part and at the middle they carry worm wheels 96 adjustable by worms 98 on a common shaft 100 by means of a hand wheel 102 arranged at the end of the shaft, vide especially Fig. 5. Hereby it is possible to adjust the level of the beam 40 and the cam 44 and thus the stroke of the pistons and the quantity of chocolate at each casting operation.

As it is necessary to retain a constant relation between the rotary velocity of the shaft 82 and the feed velocity of the conveyor 54 and, on the other hand, it is desired that the length of the casting period can be varied without altering the shape of the cam disc 80, according to my invention special means are provided, by which the end of the push rod 72, co-operating with the cam disc 80, can be swung to and fro in the plane of the cam disc in rhythmus with the reciprocating movement of the pawl 68 so that the action of the cam disc is accelerated or retarded. These means comprise an arm 106 swingable on a stationary pivot 104, said arm resting against a cam disc 110 on the shaft 82 by means of a roller 108.

By a link 112 the arm 106 is connected to an arm 114 which oscillates a shaft 116 which, as shown in Fig. 5, is journalled in the right bracket 50 and a bearing 118. At its left hand end the shaft 116 carries a cross-piece 120 with a longitudinal undercut notch 122 in which the pin 76 can be secured in arbitrary positions by means of a hand wheel 124.

When the roller 108 runs on the rotating cam disc 110 the arm 114 and thus the shaft 116 and the cross-piece 120 are swung to and fro. If the pin 76 is located co-axially to the shaft 116, this is of no influence on the co-operation between the roller 78 and the cam disc 80 and the drive mechanism functions as previously described. If, on the contrary, the pin 76 is adjusted excentrically in relation to the shaft 116, the push rod 72 will be swung to and fro about its left hand end and thus the roller 78 will run more rapidly or slowly

along the curved part of the cam disc 80 so that the time for the active advancing movement of the pawl wheel 66 is shortened or lengthened, respectively, whereby the length of the casting period of the pump is subjected to a corresponding variation.

When the drive mechanism is arranged as described, one casting will occur for each mould plate 56 on the conveyor 54. This is suitable for casting relative great chocolate cakes in which the mould cavities occupy the greater part of the width of the mould plates 56. In casting smaller chocolate pieces, in order to obtain the greatest possible capacity of the apparatus, it is necessary to arrange more mould cavities crosswise on each mould plate. If the earlier presupposed condition is retained, viz. that the shaft 82 is to be rotated by one revolution for each advancing of the conveyor by one mould plate width, on each revolution of the shaft 82 will fall a number of, say three, separate casting periods. This can be obtained by substituting the cam discs 80′ and 94′ shown in Figs. 7 and 8, respectively, for the cam discs 80 and 94.

On the first mentioned disc 80′ the former uniformly increasing part is substituted by three parts *a* with increasing radius vector and two parts *b* with constant radius vector. On the last mentioned disc 94′ three projections *c* are found insead of a single one.

By the alteration described the quantity of chocolate for each casting period will be reduced to one third. However, this can be remedied, if required, by interposing other gears 62. If for instance a gear with a gearing ratio of 1:3 is interposed so that the rotary speed of the pump is increased relative to the rotary speed of the pawl wheel 66 the previous quantity for each casting operation will again be reached.

From the above stated it will appear that the apparatus can be suited to any number of mould cavities crosswise to the mould plates, it means in the direction of movement of the conveyor. By application of different insertion pieces 36, furthermore, an adaption can be obtained to different numbers of mould cavities longitudinally to the mould plates. Thus the insertion piece 36 shown in Fig. 2 is suited for twelve cavities lengthwise while the insertion piece 36′ of Fig. 3 is suited for four such cavities, which corresponds to the division of the mould plate 56 shown in Fig. 5.

The altered embodiment of the pump, shown in Fig. 10, differs from that described above therein, that the pistons are formed as plungers 126, the inner ends of which are secured to a beam 128 arranged in axial direction in the central space in the body 16. This body, as hitherto, is driven by means of the gear wheel 18. The ends of the beam 128 is formed as pivots carrying rotatable rollers 130. The operative movement of the plungers 126 is produced by cams co-operating with the rollers 130. Each roller 130 is moved in the inward direction during the rotation of the body 16 by the inner edge face of a cam 132 at the end of an arm 134 secured to the end of the casing 10.

When the plungers 126 are to perform their discharge stroke the roller 130 is moved in the outward direction by a curved notch 137 in a campiece 136 secured to the inner side of an arm 138 pivoted on a stud 140 secured to a bracket 142 on the casing 10. The shape of the notch 137 is best seen in Fig. 9. When the arms 138 are held stationary and the body 16 is rotated, the plungers 126 will be driven to and fro in their corresponding cylinder bores in a similar manner as described in connection with the first embodiment, the suction stroke taking place when the free ends of the cylinder bores have connection to the chamber 32 containing the chocolate, the discharge stroke occurring when the free ends of the cylinder bores are connected to the cavities 34 as previously explained.

The drive mechanism shown in Fig. 11 contains a driving shaft 144 moved synchronously with the conveyor of the casting machine by means of a gear wheel 146. The shaft 144 is journalled in a suitable manner not shown in Fig. 11. The same applies to the other shafts shown in the same figure and mentioned later on.

To the shaft 144 is secured a cam 148 co-operating with a roller 150 on an arm 152 swingable on a shaft 154. To the arm 152 is secured a ledge 156 co-acting with a roller 158. This latter roller is carried by a slide 160 displaceable in a slot 162 in a coupling member 164 co-operating with another coupling member 166 secured to a shaft 168, by means of spring pressed rollers 170 and inclined faces forming a one-way clutch in the well known manner. By means of a spring, schematically shown at 172, the member 164 is swung in the clockwise direction, by which movement the clutch is inactive. The shaft 168 is in driving connection with an other shaft 174 by gears 176. The shaft 174 carries a gear wheel 178 which intermeshes with the gear wheel 18 at the end of the annular body 16.

The transmission described for driving the pump is constructed with the object in view of making it possible to drive the pump with a great variety of velocities relative to the velocity of the conveyor. This is obtained mainly by the arm 152 interposed between the cam 148 and the clutch member 164. When the slide 160 occupies the position shown in the slot 162 the distance from the contact point of the roller 158 to the axis of the shaft 154 is comparatively short and the distance from the said point to the axis of the shaft 168 is comparatively long and thus a certain angle of oscillation of the arm 152 produced by the cam 148 will produce a comparatively small angle of oscillation of the coupling member 164. If now, by means of a screw spindle 180, the slide 160 is moved to the inner end of the slot 162, the same angle of oscillation of the arm 152 will produce a comparatively great angle of oscillation of the member 164. The rotation of the annular body 16 at each step of movement thereof will be proportional to the extent of each oscillatory movement of the coupling member 164.

If a still smaller rotation of the annular body 16 is required for each oscillatory movement of the coupling member 164, the movement of the latter in the clockwise direction may be restricted by means of a projection 182 on the member 164 co-acting with a cam 184 on a controlling shaft 186. When this shaft is adjusted in the clockwise direction, the cam 184 will abut on the projection 182 and turn the member 164 in the anti-clockwise direction so that the roller 158 will be lifted from the ledge 156. Accordingly a part only of the oscillatory movement of the arm 152 will be transmitted to the member 164 with the result, that the latter will perform a small oscillatory movement only.

The purpose of making the arms 138 swingable is to produce a small retractive movement of the plungers at the end of the discharge stroke as mentioned in connection with the embodiment first described.

It will be seen that if the roller 130 shown in Fig. 11 comes to rest at the end of a discharge stroke in the position shown in relation to the cam-piece 136, a small swinging movement of the arm 138 in the anti-clockwise direction will produce the retractive plunger movement aimed at. This movement, which ought to be rapid, is produced by the following mechanism.

The shaft 144, by means of gears 188, is in driving connection with a shaft 190 carrying a cam 192. This cam co-acts with a roller, not shown, at the end of an arm 194 secured to a shaft 196. The oscillatory movement of the arm 194 is transmitted to a shaft 198 by means of a link 200 and an arm 202. On the shaft 198 is secured a cam 204 co-operating with a roller 206 at one end of a push rod 208, the other end of which is pivoted to the arm 138.

Now the phases of the movements of the two shafts 144 and 190 are so timed that when the pump is at the end of a delivery stroke, the roller on the arm 194 runs down a substantial radial edge 210 on the cam 192. This will produce a sudden anti-clockwise movement of the shaft 198 with the result, that the roller 206 rapidly will run down the cam 204 and that the arm 138 will be swung rapidly in the anti-clockwise direction by means of a spring, as schematically shown at 212, thereby producing the small retraction of the plungers mentioned above. When the uniformly increasing part of the cam 192, thereafter, is active, the shaft 198 will be swung slowly in the opposite direction with the result, that the arm 138 is swung slowly back to its initial position thereby producing a small increase in the delivery stroke of the plungers active at this time over that determined solely by the rotation of the pump, this being of no practical importance to the operation of the pump.

It will be understood that similar means as those shown at the front end of the pump for moving the arm 138 will also be present at the back end for moving the arm at that end, even if they are not shown. If desired, also the pump body 16 may be driven at both ends by means similar to those shown at one end thereof.

My invention is not restricted to the special embodiments shown and described, which are to be regarded as examples only, as the same may be altered in various ways without departing from the spirit of the invention.

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CASTING APPARATUS FOR USE IN MACHINES FOR CASTING CHOCOLATE AND THE LIKE

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4 Sheets-Sheet 1

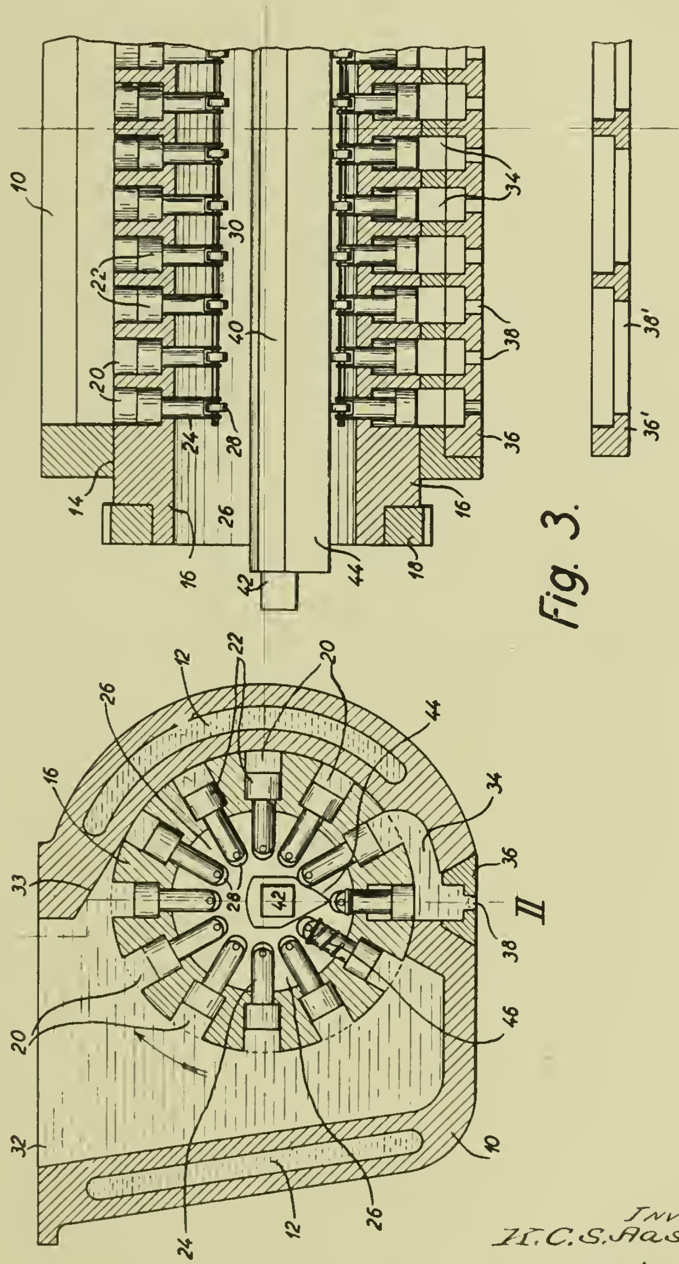

Fig. 2.

Fig. 3.

Fig. 1.

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BY A. P. C.

K. C. S. AASTED
CASTING APPARATUS FOR USE IN MACHINES FOR
CASTING CHOCOLATE AND THE LIKE
Filed Aug. 10, 1940

Serial No.
352,165

4 Sheets-Sheet 2

Fig. 5.

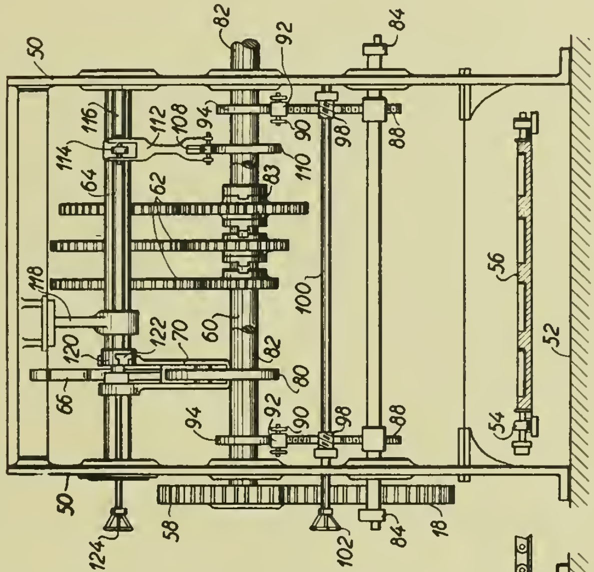
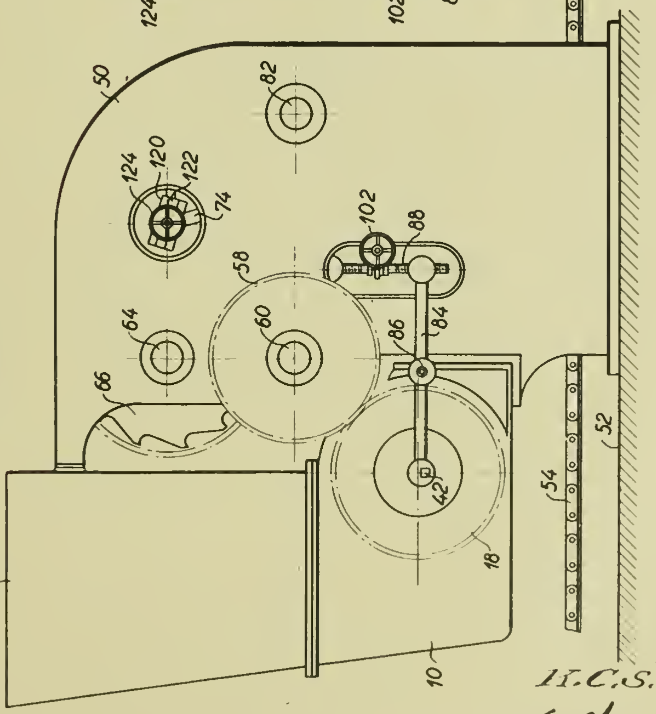


Fig. 4.



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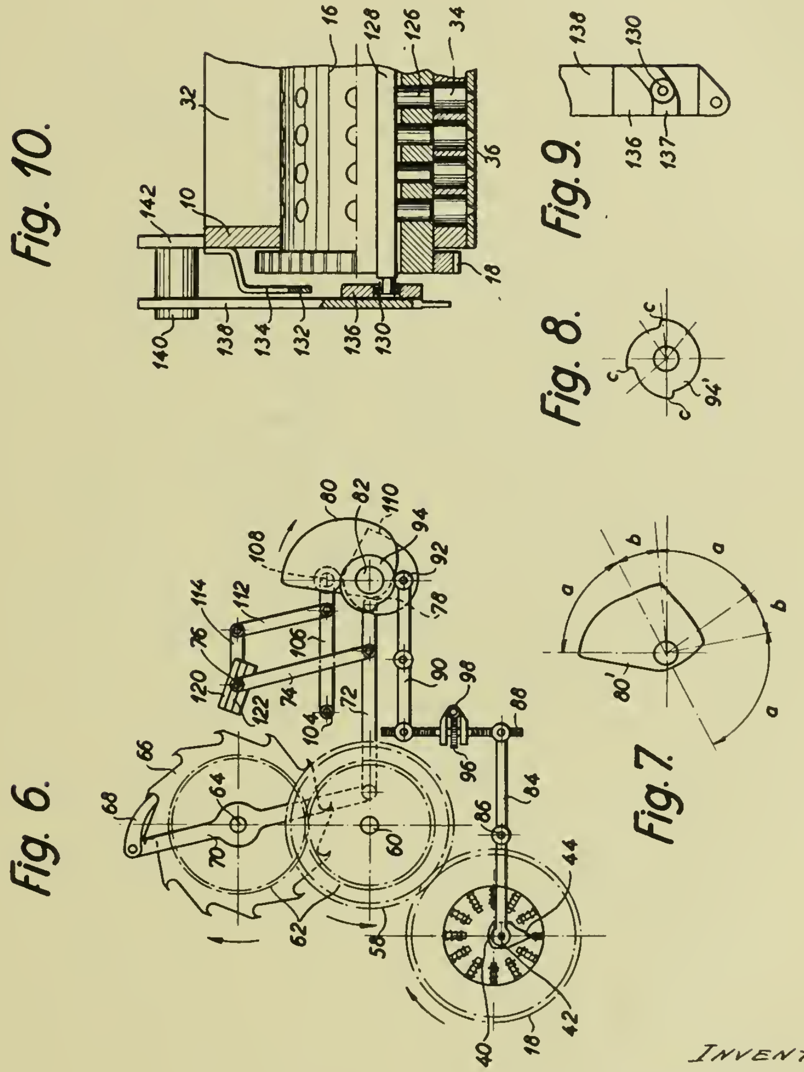
4 Sheets-Sheet 3



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4 Sheets-Sheet 4

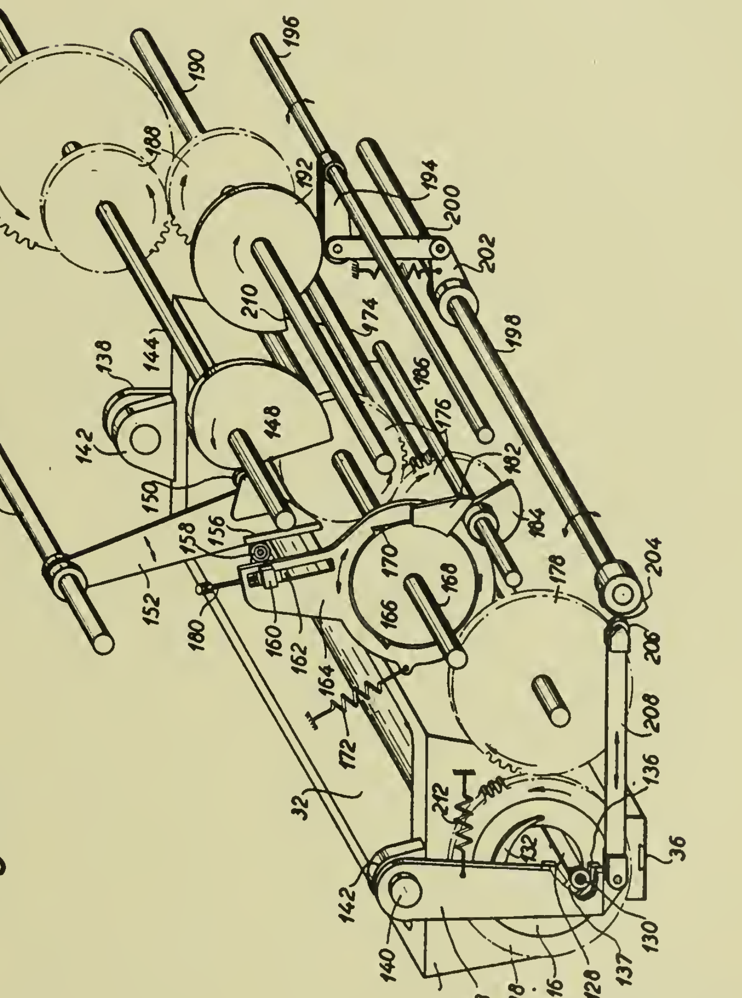

Fig. 11.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF WHITE OPAQUE ENAMELS

Walter Kerstan, Frankfurt A. M., Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 24, 1940

The invention relates to the production of white opaque enamels using gas opacifiers more particularly in the use of opacifiers made from organic compounds. The process is especially suitable for enamels which are either poor in boron or entirely free of boron.

Gas opacification depends as is known upon the fact that substances which can be decomposed with evolution of gas are added to an enamel mixture which on stoving of the enamel produce a white opacity by formation of small gas bubbles.

The most varied substances have already been suggested as gas opacifiers, for instance, coloring agents, fatty acids and their salts, aromatic carbonic acids and their salts, naphtholes, resins, pitches, tars, asphalts and the like.

Careful investigations and experiments have shown that the effect of gas opacifiers is greatly dependent upon the composition of enamel mixture, especially in view of the viscosity of enamel melts. Hence quite special enamels were often used in order to obtain a uniform opacity with the known gas opacifiers. The composition of these special enamels was adapted to the used gas opacifiers in such manner as to soften the enamels at definite temperatures and to obtain melts of definite viscosity which prevented the escape of the formed gas bubbles.

Through further investigations and experiments I have found out that the effect of the known gas opacifiers substantially depends on the content of boric acid or other boron containing substances such as borax or the like which are present in the enamels mixtures or frits.

Now I have found that a certain group of substances, i. e. non gaseous unsaturated organic compounds such as vinylic compounds, acrylic compounds or the like or their natural or artificial polymerisates yield to an excellent and especially very uniform opacity if such enamel mixtures are used as they contain no boron compounds, for instance, boric acid, are not suitable or only badly suitable for gas opacities.

Suitable opacifiers are, for instance, vinyl acetate, vinyl chloride or the like, vinyl ether, furthermore esters, amides or nitriles of acrylic acid and its homologues, for instance methacrylic acid, styrol or the like. The unsaturated organic compounds may be used either alone or in mixtures or in form of their polymerisate, mixed polymerisates or polymerisate mixtures. It is also possible to use the aforesaid unsaturated compounds which are only partially polymerized either alone or in mixtures. Especially suitable are, for instance, polymerisates of unsaturated hydrocarbons and their derivatives, for instance, insoprene-, butadien- or chloroprene polymerisates. Natural products such as natural caoutchouc, rubber, gutta percha, balata have also proved advantageous.

The gas opacifiers according to my invention may be used either alone or in mixture. Unsaturated compounds may be employed, for instance, together with polymerisates wholly or partially polymerized compounds or with both these substances. I have made the surprising observation that natural rubber or synthetically produced rubberlike substances such as, for instance, Buna, are especially advantageous if frits are used which are either poor in boron or entirely boron free.

In accordance with kind and quality the white opacifiers may be used as such or in form of solutions. Solvents are, for instance, organic substances such as gasoline, benzole, and other hydrocarbons, chlorinated hydrocarbons, alcohols, esters, ketones or the like. These opacifiers may also be used in natural or artificial dispersions or emulsions, for instance, in the form of latex.

The process according to my invention may be carried out by mixing enamel clay with liquid opacifiers or solutions or emulsions thereof. After the evaporation of the solvents—either wholly or partly—the mixture is added to the mill. Thus, for instance, ordinary enamel clay may be mixed with a solution of a butadien polymerisate or polystyrol in benzene or the like whereby about 10 grs polymerisate are added to 100 grs of enamel clay. The ingredients are mixed intimately resulting in a thin pulpy mixture; the solvent is distilled off and the remaining mixture is worked up accordingly.

The process has been proved excellent for boron free or boron poor enamels, especially industrial enamels. The extraordinarily uniform decomposition of the gas opacifiers according to my invention is probably based on the fact that various procedures such as cracking, polymerising, depolymerising and so on proceed either alternately or simultaneously.

The following are examples of the make-up of mixtures to be employed according to my invention:

		Parts of weight
1.	Field spar	50
	Quartz	5
	Borax	[1] 8
	Sodium carbonate	8
	Sodium nitrate	2
	Natriumsilico-fluoride	10
	Fluor spar	2
2.	Field spar	50
	Quartz	5
	Sodium carbonate	16
	Sodium nitrate	2
	Natriumsilico-fluoride	10
	Fluor spar	2

[1] Corresponding to 2,8 boric acid anhydride.

For instance, I proceed as follows:

25 grs of buna or crepe caoutchouc are dissolved in 1000 cc benzene and at a temperature of 40° C introduced into a shaking apparatus.

The resulting clay dross is then dried at a temperature between 60 and 80° C, and the dry residue ground to a fineness of 3600 mesh. The so formed gas opacifier is added to the enamel mixture in a quantity of about 2%, corresponding to an addition of 0,05% buna or caoutchouc. If desired, more clay, for instance, about 6% more may be added to the mill. Enamelling and firing is carried out as usual.

Thereafter the solution is finely ground with 1000 grs clay in a porcelain mill.

WALTER KERSTAN.

Published June 8, 1943

Serial No. 358,511

ALIEN PROPERTY CUSTODIAN

METHODS AND MEANS FOR PRODUCING TELEVISION IMAGES

Heinrich Strübig, Teltow, Germany; vested in the Alien Property Custodian

Application filed September 26, 1940

The invention relates to methods and means for producing images upon a screen which can be viewed from the front or rearside and in particular for the projection of television images upon a screen having a large surface by means of cathode ray tubes.

It is an object of the invention to produce a bright television image on the receiving side by making use of the principle of optical storage of picture elements. It is another object to utilize a transparent medium or substance which under normal conditions has no colour but which assumes a colour or a dark shade under the influence of impacting electrons. It is a further object to use a material the transparency or opacity of which can be varied by the direct impact of electrons and which retains its opacity for a desired period. The colouring or darkening can be reversed by a simple process after the image has been used for the projection or after it has been viewed by the observer so that a new image can be produced on the same screen.

A further object is to improve the systems in which an image is produced by providing a substance on the bottom of a cathode ray tube changing its colour under the influence of heat produced by the bombardment with electrons. Such a substance, f. i. silver-mercury-iodide, has the property to change its colour from red into yellow with higher temperatures. Experiments have shown that such substances have a high vapour pressure so that they cannot readily be used in high vacuum vessels. Furthermore these images cannot be projected as diapositives because the dark and bright portions have nearly the same opacity.

According to the invention the image is produced upon a layer consisting of an alkaline earth halide on a transparent carrier by direct electron impact. The method has the advantage that images with strong, f. i. dark-blue contacts appear upon a colourless or transparent background so that they can be easily projected.

The alkaline earth halides have the property that they change their colour under the influence of fast electrons; f. i. rock salt (HCl) changes its colour from clear transparency to a yellow colour. This colouring can be quickly and completely reversed by heating the material for a short time or by exposing it to infrared light. Examples of such materials are the chlorides, bromides, and iodides of sodium and potassium, lithium bromide, calcium fluoride, and strontium fluoride and chloride. The material may be in the form of a single flat crystal, but it is, however, preferable to use a layer of small crystals or a layer having a micro-crystalline structure.

A substance which is particularly sensitive to cathode rays and shows a good colouring effect is potassium bromide or a mixture of potassium bromide (KBr) and potassium hydride (KH). The potassium hydride is preferably added as an activator so that the layer contains f. i. 1000 parts potassium and 1 part potassium hydride. A layer composed in this manner becomes dark-blue or black under the influence of fast electrons. A screen composed of a material of this type can be used as light-relays in a projection apparatus.

Other aspects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claim.

Referring to the drawing

Fig. 1 shows a view of a device including a film for the projection of images,

Fig. 2 a section through a cathode ray tube for producing the images,

Fig. 3 a section through a cathode ray tube used in a projection apparatus.

The cathode ray tube 1 of Fig. 1 is represented in Fig. 2 on a larger scale. The tube 1 includes a Lenard-window 2 having the form of a slot covered with a foil of aluminum or another suitable material. The tube contains furthermore a deflecting system 3 consisting of plates, a heated cathode 4 and a control-electrode 5 as well as one or more lens-electrodes 15. The tube is surrounded by a concentrating coil 16. In front of the tube 1 a film 6 is arranged. The film carries a thin layer of potassium bromide in the form of finely divided crystals. This layer is directed towards the window 2 of the tube 1. The potassium bromide is applied to the film and connected thereto by means of a suitable binder, f. i. a transparent lacquer. The arragement of Fig. 1 contains furthermore a film projector 7 of known construction and a heating chamber 8 including a number of heating elements, f. i. in form of electrically heated wires or of electrical incandescent lamps 17. In the heating chamber the film is exposed to the heat of the heating elements so that the image is removed and the potassium bromide returned to its original state. As the image produced in the layer of potassium bromide is sensitive to heat it is preferable to employ in the projection apparatus a heat filter, f. i. in form of a water container, through which the light rays are made to pass in

order to prevent that the image is destroyed during the projection. A suitable motor is arranged in the projection apparatus 7 for moving the film through the device.

The operation of the device is as follows:

The cathode ray tube 1 is connected to a terminal of a television receiver so that the control electrode 5 is controlled by image currents. The cathode ray is moved under the influence of the line deflecting system across the Lenard window in synchronism with the scanning movement at the transmitting side. If the film covered with the potassium bromide is moved with uniform speed vertically to the direction of the line, the potassium bromide is changed in its colour line by line in accordance with the intensity of the cathode ray passing through the Lenard-window, so that a reproduction of the image is produced on the film.

The direction of the image impulses is chosen in such a manner that the image on the film is a positive image. This image is projected immediately by means of the projection apparatus 7 and is wiped out in the heating chamber 8. The length of film required for this device is comparatively short and is chiefly determined by the length of film required in the heating chamber for completely eliminating the image. A certain length of film is required for forming loops between the intermittently operating projector and the continuously moved remaining part of the film.

As the potassium bromide has an absorption in the yellow part of the spectre, it is advantageous to use for the projection apparatus either a source of light emitting a comparatively small portion of blue and a large portion of yellow rays, f. i. a sodium vapour lamp, or to employ a yellow projection screen or a yellow light filter. It is, however, also possible to obtain a black and white image with white light. In this case thin layers of a substance absorbing blue rays and another substance absorbing yellow rays, f. i. potassium bromide and rock-salt, are placed one upon the other. Images with such a system have purely black and white contrasts.

Another embodiment represented in Fig. 3 shows a cathode ray tube 22 in which a layer of potassium bromide 9 is arranged within the tube envelope 18. The electron-gun 10 is arranged in the neck 19 of the tube so that the screen 9 can be arranged in the path of an optical system including a condenser 13 and a projection lens 14. Contrary to the embodiment of Figs. 1 and 2, the cathode ray tube requires in this case a second deflecting system 12 besides the deflecting system 11. The lens system including the condenser 13 and the objective 14 directs the light of an arc lamp 20 towards a projection screen 21. The image is made to disappear by passing over the screen a ray of infrared light. The cross-section of this ray corresponds approximately to the length and the height of one or more lines and is moved across the image with such a speed that the light-ray impinges upon a portion of the screen which is situated shortly in front of the line scanned by the cathode ray. Each point of the image screen is therefore prepared for receiving a new impression shortly before the cathode ray scans this point of the carrier.

In case the layer consisting of small crystals is fastened to the carrier in such a manner that the crystal particles are in contact with the carrier at one side only, the complete layer has a white appearance so that a very strong source of light is required for producing bright images. A considerable improvement can be obtained by embedding the crystal powder into a transparent mass having the same refractive properties as the crystals. In this case the screen is clear and transparent when no picture is excited thereon. The crystals are embedded in such a manner that the binder covering the crystals is very thin so that the electrons can easily pass through the binding material and act upon the crystals.

HEINRICH STRÜBIG.

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H. STRÜBIG
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Fig.1

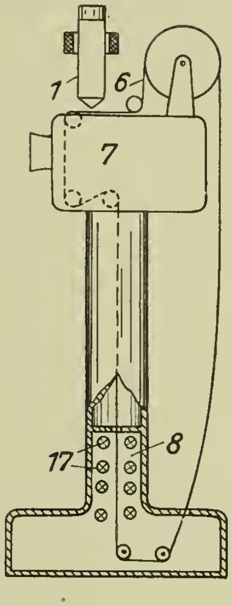


Fig. 2

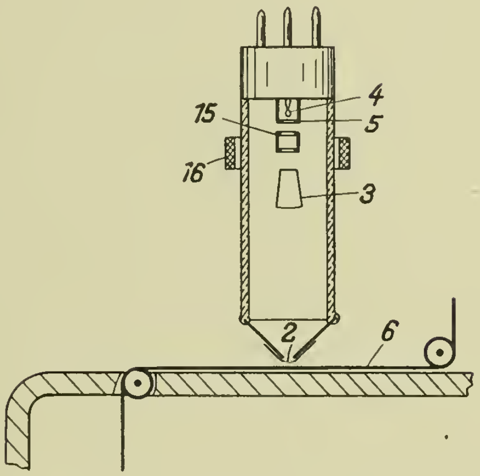
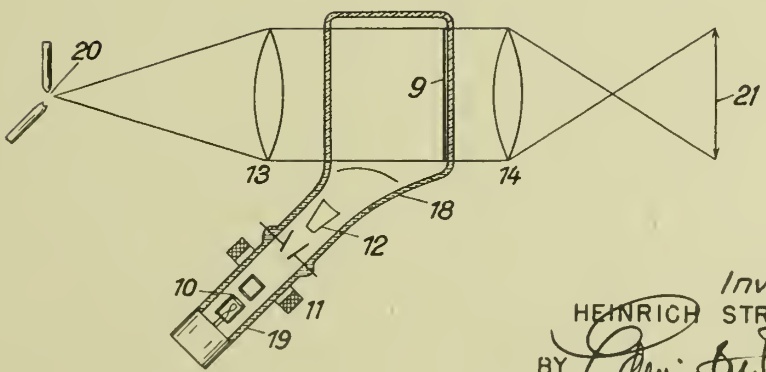


Fig. 3



Inventor:
HEINRICH STRÜBIG
BY
ATTORNEY

Published June 8, 1943

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ALIEN PROPERTY CUSTODIAN

LATHE OR SIMILAR MACHINE TOOL AND A METHOD AND DEVICE FOR PUTTING THE SAME TOGETHER

Johannes Wilberz, Hilden on-the-Rhine, Germany; vested in the Alien Property Custodian

Application filed September 26, 1940

This invention relates to a lathe or similar machine tool, in which the bed-body, uprights or the like carrying the working-, controlling- and driving-elements and the like, contrary to the usual constructions, only partly consist of metallic material such as cast iron, cast steel, for instance only on the side and end faces, and the other elements consist of concrete or a similar plastic and then hardening material.

It is known, to produce certain elements of a machine tool of metals and then to simply embed these elements in concrete. In this manner all occurring forces are also transmitted upon the parts of the machine which consist of concrete and evidently must also be taken up. As in this instance pressing forces are less considerable but very strong tensile-, bending-and torsion-forces have to be taken up, which cannot be taken up just by the concrete owing to the physical properties of this material, the result is, that the connection points between metal and concrete loosen rapidly and the concrete itself becomes brittle and breaks. Herefrom results that this proposition is not suitable for the construction of machine tools.

By the invention the inconveniences of this older proposition are, however, overcome and thereby that the end-or side parts of the upright or frame elements consist of continuous metallic parts which in turn take up all occurring external forces thereby that the arrangements for feeding and other movements, usually provided in the frames or uprights, are rigidly connected or connected by screws with these end-or side parts after the still existing hollow spaces have been filled with concrete, so that the concrete filling as such is relieved of these forces and stressed merely on pressure. Only hereby the employment of concrete is possible also for the construction of uprights or frames for machine tools.

The application of the idea to spar benches, that is to lathes in which the steel carrier slides on a round guide, is especially advantageous, as the spar bench is carried by two uprights separated the one from the other.

In spar benches according to the invention only the end faces besides the driving and control elements are made of comparatively thin plates of cast iron or cast steel. All what is between them is of concrete or similar material.

By this new manner of construction of beds or uprights of lathes considerably simplified preliminary conditions for the putting together result, so that even the putting together can be carried out with the aid of unskilled men. This is valid also for spar benches, in which the further advantage is obtained, that the uprights, contrary to the usual method of putting together, need not be finished any more apart from the necessary finishing work of the flat cast plates for the end faces.

The uprights built up according to the invention require therefore no drilling on a horizontal drilling mechanism nor milling and planing, so that the putting together of the benches is considerably simplified and can therefore be carried out in a short time, so that it is possible to produce a large number of such benches in a short time.

From the method for putting together spar benches, to which the present invention further relates and which will be hereinafter described, can be seen how simple the building up is.

In the method according to the invention one starts from a base body which, with the aid of suitable eyes, extensions, bores, indentations or the like, determines the position of the individual elements of the bench such as spars, head stock, tail stock and so forth, and two end face plates, spaced at a distance equal to the width of the upright, are mounted on either side of the base body in the direction transversely to the axis of the spar. Through the apertures cast into these comparatively thin face plates the corresponding individual elements are inserted from the side so that they bear on the base body at predetermined points.

It is further very material for the simple and rapid putting together that the individual parts of the bench, such as for instance the spars, the cylinders for the carriage drive when compressed air is used as driving medium, are first produced and consist essentially of turned bodies which can be made comparatively easily. These individual elements are placed as a whole into the plates of the upright. According to the constructive conditions and the other construction of the spar bench it may also be possible or necessary to fix on the base body certain elements before the end face plates of the two uprights are put on. If the putting together has progressed so far that the plates for the end faces are fixed at a distance apart corresponding to the width of the upright, a jacket of sheet metal may be placed between the corresponding edge beads of the plates for the end faces and destined for covering the side faces and end faces of the uprights. The hollow space thus formed in the upright is then filled with concrete or with a similar material which is first plastic and hardens subsequently.

It is material to fill also with concrete or similar material the intervals between the elements inserted into the uprights and the corresponding apertures in the end face plates, so that after hardening of the concrete not only pressure-proof uprights exist, which have been produced with as little metallic material as possible, but also the concrete carries the elements inserted into the uprights.

In this manner it is possible, as already stated above, to use the end face plates without treatment on drilling mechanisms or the like directly after the casting and finishing, as accurate drilling of the apertures for the individual elements on the end face plates is not material, as intentionally a narrow annular space is provided at the points opposite the inserted elements, this hollow annular space being also filled with concrete. Only after the concrete or the like has hardened the positive connecting direct connection between the elements embedded in the concrete with the plates for the end faces of the uprights is produced, so that the external forces are taken up by metallic elements as in known fully-metallic uprights. On the one hand to the metallic elements and on the other hand to the concrete only those stresses are allotted by this kind of mounting and by the introduction of the forces, which can really be taken over by the individual materials owing to their physical properties.

The invention relates further to a device for carrying out this method for the production of spar benches.

According to the invention a base plate is provided in the middle of which the base body is arranged which, with the aid of indentations, projections, bores or the like, determines the position of the individual elements of the lathe, so that at the putting together it is merely necessary to push in the individual elements of the lathe at the corresponding points of the base body, or to fix them anyhow. For building the uprights frames are further arranged on the base plate one at each side of the base body in the direction of the spar axis. This frame consists substantially of two pairs of upwardly directed walls with faces parallel to the spar axis the width of these faces corresponding to the width of the upright and the inner surfaces of them to the sides and end faces of the uprights, so that these walls are completed to a U-shaped cross-section with arms preferably extending in upward direction.

In the accompanying drawing a device for putting together a spar lathe is diagrammatically illustrated by way of example, the whole bench being built together standing upside down.

In the drawing the base plate of the apparatus is designated by 1 and the base body, which is only partly shown, is designated by 2 and cast in one piece with the base plate. The base body 2 has bores, indentations and the like such as the bores 3 and 4 shown by way of example. Into these bores shafts 5 and 6 are inserted from the right side. Stops 7 and 8 are rigidly connected with the shafts, whereas the other stops 9 and 10 are screwed on from the other side and secured in position on the correct point by nuts. Cast end face plates 11 and 12 are pushed in from the side until they bear against the corresponding parts of the base plate 1. Covers 13 of sheet metal are then erected which determine the width of the uprights and serve at the same time for covering the top and side faces of the uprights. The outer cast end plates 14 and 15 are then put on and from the sides the corresponding parts of the spar bench are inserted into the apertures cast in all end plates of the uprights. In the left upright formed by the plates 12 and 15 the sleeve 16 for guiding the spindle is inserted and on the opposite side the tailstock feeding cylinder 17 and further the guide sleeve 18 for the spars on both uprights. The position of these elements is determined by the shafts 5 and 6 or by the stops provided on these shafts, and so that after the elements of the spar bench have been inserted other stops 19, 20, 21, and 22 are mounted on the shafts 5 and 6. The shafts 5 and 6 ensure in this manner a centering of the parts to be inserted between the end plates, the position of these parts being thus accurately determined. If thus the position of all individual elements relative to the end plates of the uprights and their mutual position have been determined the space existing between the end plates 12 and 15 and the sheet metal cover 13 on the left hand side of the spar bench and on the other hand between the end plates 11 and 14 and the sheet metal cover 13 on the right hand side of the spar bench is filled with concrete which may be rammed in if desired. The whole construction may be left standing until the concrete has hardened and then the shafts 5 and 6 and all stops are removed, and only into the elements 16, 17 and 18 embedded in the concrete the corresponding arrangements on the spar bench, that is in the present instance the spindle with the catch arrangement, the piston for pushing forward the headstock and the spars are inserted and the connection of all these elements with the face plates 11, 12, 14 and 15 is established.

In order not to complicate the drawing too much the clearance between the bodies to be inserted and the corresponding apertures in the end plates has not been shown.

JOHANNES WILBERZ.

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J. WILBERZ

LATHE OR SIMILAR MACHINE TOOL AND A METHOD AND DEVICE FOR PUTTING THE SAME TOGETHER

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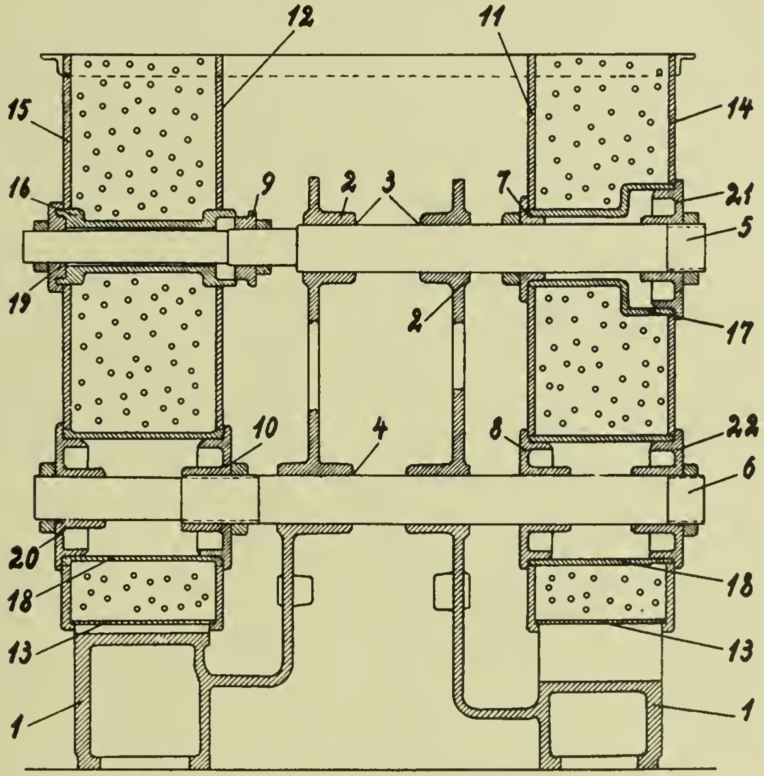
Serial No. 358,562



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By: Glascock Downing & Seebold
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ALIEN PROPERTY CUSTODIAN

TRANSMISSION DEVICES WITH SINGLE DIRECTION OF ROTATION, FOR LARGE DRIVING COUPLES, COMBINED WITH HIGH FREQUENCIES OF ACTION AND HIGH SPEEDS

Baptistin Branda, Marseille, France; vested in the Alien Property Custodian

Application filed November 13, 1940

Transmission devices with drive in one direction of rotation only, based on the principles of friction locking, and in particular by employing the locking of balls or rollers between two surfaces, of which the planes tangential to the points or lines of contact form between them angles of sufficiently small dihedral, have been made for many years.

All devices of this type used up to the present only allow the transmission of small driving couples, especially when it is a question of high frequencies of action and high speeds.

The object of the present invention is to remedy the insufficiency, whilst at the same time keeping the device to reasonable dimensions.

In order to understand the description better, the attached drawing shows, as an example only, a form of application of the invention, this not being limitative as to shape, the position of the components, the dimensions or the nature of the metals utilised.

In this drawing:

Figure 1 shows a longitudinal section through the axis of the new device.

Figure 2 is a section through 21—21 of Figure 1, drawn to a larger scale in order to show the details more clearly. The rollers are not shown in section.

Figure 3 is also a section through 21—21 of Figure 1, but with a variation in the arrangement.

Figure 4 gives two views of the details of the plate springs.

Figure 5 shows in detail the placing of the plate springs prior to being placed in position.

In Figures 1 and 2, a shaft 1, rotating in bearings such as 3, is provided with a flange 4, on which a drum 5 is adjusted, and which is closed by a cover 6. The flange and the drum are held together by stud-bolts 7.

On the other hand, a shaft 2, independent, but with the same axis of rotation as shaft 1, terminates in a hollow cylinder 8, in which the drum 5 can enter freely. Shaft 2 rotates in bearings such as 9.

The exterior of the drum 5 is grooved longitudinally as shown in Figure 2 Each groove has a radial ridge 10 and a flat portion 11, which constitutes its basis and forms an angle α of 85° with the corresponding radius as shown in Figure 2. The ridges and the flat portions are united by curves of suitable radius.

The grooves are narrow, in order to have as many as possible, and they are each provided with one or more small rollers 12, of from $3^m/_m$ to $5^m/_m$ in diameter for example. In the case in question, there are two rollers in the same axis of rotation for each groove, as can be seen in detail in Figure 5.

When the rollers bear simultaneously on the interior of the cylinder 8 and the flat surfaces 11 of the grooves, there is a space between each ridge and its corresponding rollers. Grease-holes 13 are pierced in the sides of the drum 5 so as to come out in these spaces. These holes insure the distribution of oil under pressure which comes from the interior of the drums 5 by means of the holes 14 and 15 in the shaft 1. The oil which flows to the exterior by means of the holes 16 in cylinder 8 causes a slight pressure between the ridges and the rollers. The latter are therefore subjected to a slight pushing movement which insures the rollers being in all circumstances in contact with the friction surfaces.

In Figure 3, the exterior of the drum 5 is cylindrical. The grooves are, in this case, made on the inside of the component 8 as shown. The spaces between the ridges 10 and the rollers 12 have been slightly increased in order to accommodate the curved plate springs 17 as shown in detail by Figure 4. Figure 5 shows exactly how to place the springs in position. The latter are of tempered steel of from $0^m/_m$ to $0^m/_m$ 3 in thickness, for example, and insure, by their elasticity, the permanent bearing of the rollers, and replace, in this case, the action of the oil under pressure. Lubrication is, however, effected by means of the holes 18 and 19, which are pierced in the components 5 and 8.

It is obvious that such springs can also be used in the arrangement shown in Figure 2. In both cases, the rollers 12 are held in position, laterally, by the base of the cylinder 8 and a slight projection of the flange 4.

The rollers and the friction surfaces must be sufficiently hard to avoid any appreciable wear while in use. In any case, the number of grooves and rollers gives contact surfaces of good length, in spite of the small overall dimensions of the device. It is thus possible to obtain very reasonable values for the unitary crushing force when employing large driving couples.

On the other hand, the lightness of the rollers practically eliminates the parasitical effects of bouncing. Such bouncing adversely affects the locking or release of the rollers, especially when it is a question of high frequencies of action and high speeds.

Finally, the pushing movement imparted to the rollers by the oil under pressure or by the curved

plate springs practically neutralises the amount of work absorbed by the friction due to the relative movements of components **5** and **8**.

Method of operation

When the shaft **1** rotates in the direction of the arrow *f* at a speed which tends to become greater than that of the shaft **2**, all the rollers without exception are locked between components **5** and **8** and thereby render the two shafts as one. On the other hand, if the speed of shaft **1** becomes less than that of shaft **2**, the rollers are released instantly and thereby render the shafts independent.

The apparatus has a reciprocal action. Thus, when shaft **2** becomes the driver, it will rotate shaft **1** as soon as its speed tends to become greater than that of shaft **1**, but in an opposite direction of rotation to that shown by *f*.

In the case of the arrangement in Figure 2, any acceleration of the driving shaft **1**, in the direction of the arrow *f*, induces, by inertia, a stronger bearing by the rollers, and this independently of the effect of the oil pressure or the action of the curved plate springs. Again, any deceleration of shaft **1** tends to induce, by the inertia of the rollers, an effect which assists in their release. These effects, of small relative value, thus increase the efficiency of the system, but are themselves sufficiently damped to avoid bouncing, which would, on the contrary, have adverse effects.

In the case of the arrangement in Figure 3, the variations in the accelerations of the driving shaft **1** have no noticeable effect on the rapidity of action of the rollers, which latter are subjected to the pushing movement imparted by the curved plate springs. The locking and release are thereby rendered more perfect.

Hence, when it is a question of very high frequencies of action, better results are given by the arrangement shown in Figure 2 than by that shown in Figure 3.

BAPTISTIN BRANDA.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

B. BRANDA

TRANSMISSION DEVICES WITH SINGLE DIRECTION OF ROTATION, FOR LARGE DRIVING COUPLES, COMBINED WITH HIGH FREQUENCIES OF ACTION AND HIGH SPEEDS

Filed Nov. 13, 1940

Serial No. 365,454

Fig. 1.

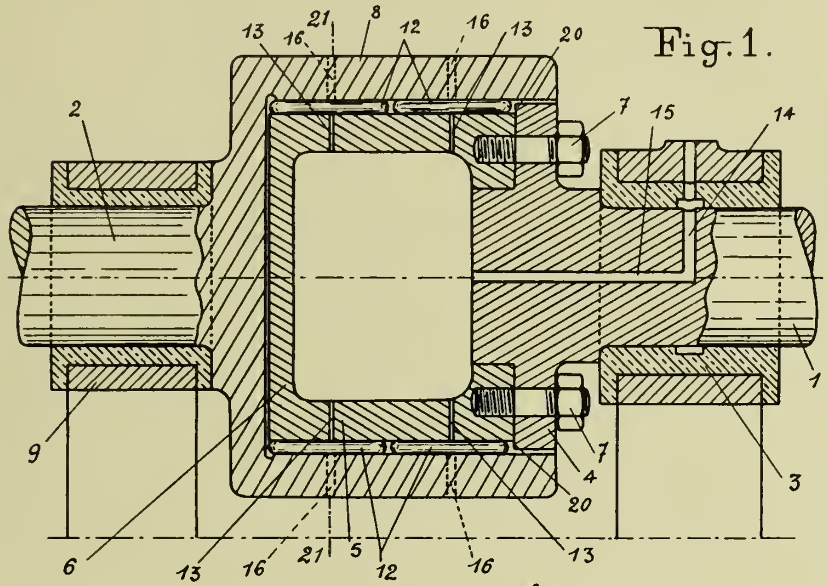


Fig. 2.

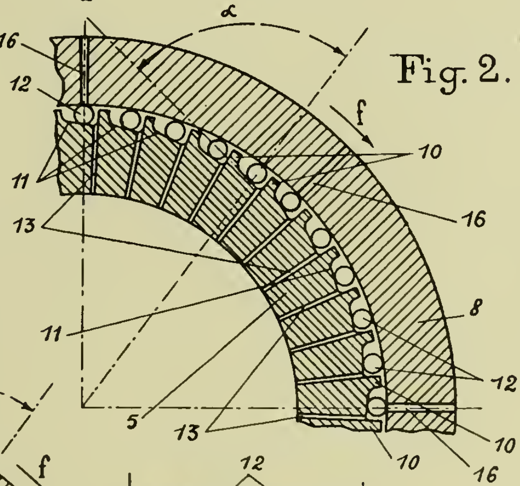


Fig. 4.

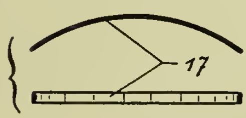


Fig. 3.

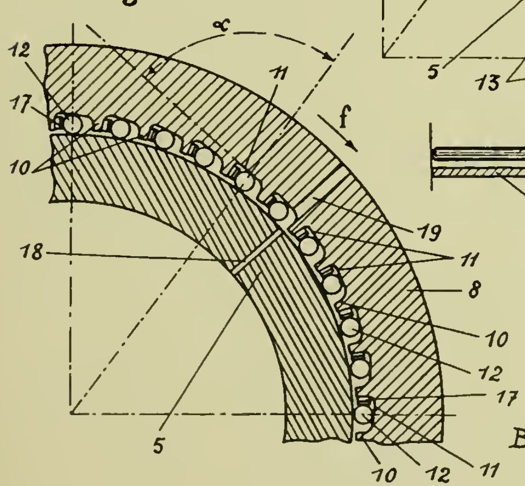
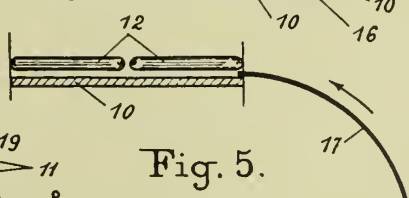


Fig. 5.



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Published June 8, 1943 Serial No. 367,231

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF HIGHER MOLECULAR ALDEHYDES AND ALCOHOLS

Rudolf Kern, Ludwigshafen-on-Rhine, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 26, 1940

The present invention relates to a process for the production of higher molecular aldehydes and alcohols.

It is already known that crotonaldehyde may be condensed to higher molecular unsaturated aldehydes by means of condensing agents such as amines and salts of amines, preferably in the presence of an excess of a weak acid. This condensation, however, generally delivers but an insufficient yield of higher molecular aldehydes because crotonaldehyde or the resulting polyenealdehydes tend to form undesirable cyclic substances or resins. The higher molecular alcohols, prepared from the condensation products in known manner by catalytic hydrogenation, thus leave a considerable residue of resinous substances when distilling.

I have now found that the said disadvantages may be overcome and higher molecular aliphatic aldehydes and alcohols may be obtained in a very good yield by carrying out the first step of the reaction, i. e. the condensation of the crotonaldehyde to higher molecular aldehydes, wholly or in part in the presence of active hydrogen under so mild conditions that no substantial hydrogenation of the aldehyde group occurs. The term "active hydrogen" is intended to comprise hydrogen in statu nascendi or hydrogen made active by the presence of catalysts. The aldehydes thus prepared may be reduced by subsequent treatment with hydrogen under energetic conditions. The formation of undesirable by-products, especially resins, is practically completely avoided by this method of working. There are mainly obtained straight-chained saturated or only partly unsaturated aliphatic aldehydes or alcohols, respectively.

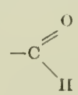
As condensing agents suitable for the purposes of the present invention there may be mentioned for example salts of amines, especially of secondary amines, preferably in the presence of an excess of a weak acid, or acid salts from polycarboxylic acids and secondary amines. Suitable salts of the said kind, for example, are those of diethylamine, methylethylamine, dibutylamine, methylcyclohexylamine, dicyclohexylamine, diethanolamine, dimethylethylenediamine, dihydroxyethylhexamethylenediamine, heterocyclic bases, such as piperidine, morpholine and pyrrolidine. Primary amines are also suitable as condensing agents, but have a tendency to cause the formation of nitrogen-containing condensation products. The salts of the amines may contain as the acid component, for example, formic acid, acetic acid, crotonic acid, succinic acid or adipic acid; mixtures of salts of the said kind may also be used as condensing agents.

The condensation may be carried out in the presence or absence of solvents or diluents, as for example methanol, ethanol, butanol, dioxane or other ethers and alcohols. Since heat is evolved during the reaction, care should be taken to regulate it by cooling and stirring. The temperature during the condensation should be kept below 80° C, advantageously between 20 and 70° C. It is often advisable to remove the water resulting in the condensation, e. g. by the addition of agents capable of binding water or by azeotropic distillation.

The condensation may be carried out under normal conditions or under superatmospheric pressure. It may be carried out in the presence of hydrogenation catalysts, for example chromium-activated nickel catalysts or by using hydrogen in statu nascendi, for example hydrogen obtained from the reaction between zinc and acids, in particular acetic acid, or by the addition of aluminum, activated by means of mercury, which combines with the water formed in the condensation, thus liberating hydrogen which in turn is saturating part of the double linkages of the polyenealdehydes.

One method of carrying out my invention consists in that the crotonaldehyde is condensed by allowing a secondary amine, as for example piperidine or morpholine, to run slowly into a mixture of crotonaldehyde and an acid, for example acetic acid. Another method consists in that the crotonaldehyde is allowed to run into a solution of a secondary amine in an excess of acid in small portions, while suspending the addition of further amounts of crotonaldehyde, until the red-colored polyenealdehydes first formed have been hydrogenated into colorless products. Finally crotonaldehyde may also be added continuously at such a speed that no red color caused by polyenealdehydes is obsevrved. When employing other condensing agents, the mode of operation may be modified in a suitable way. It is understood that, regardless of the method of bringing together the reactants, the condensation is carried out at least partly in the presence of active hydrogen.

The aldehydes obtained in the first step of this invention may be directly hydrogenated to alcohols, if desired after previously separating the condensing agents. This second step is carried out under so energetic conditions that the



group of the aldehydes is converted into the —CH_2OH— group, by using ordinary or increased pressure and working, for example, at a temperature above 80° C, preferably between 120° and 200° C, in the presence of the usual hydrogenation catalysts. When employing pressures of between 50 and 250 atmospheres, the hydrogenation

of the aldehyde mixture to alcohols proceeds very smoothly.

The following examples serve to illustrate how the present invention may be carried out in practice, but the invention is not restricted to these examples. The parts are by weight.

Example 1

350 parts of crotonaldehyde are dissolved in 900 parts of methanol and 60 parts of glacial acetic acid and 50 parts of a Raney-nickel catalyst are added to the solution. Then 25 parts of piperidine are allowed to run into the solution in portions and, as soon as the temperature rises, hydrogen is introduced through a sieve plate while stirring. The temperature slowly rises to from 50° to 55° C; if the temperature should rise too rapidly, there is slightly cooled. Stirring is then continued for another 12 hours while introducing hydrogen. In order to gain the resulting hydrogenated aldehydes, the reaction mixture is filtered; after evaporating the solvents the residue is distilled under reduced pressure. In order to gain alcohols in the second step of the reaction the distilled aldehyde mixture may be reduced, if desired in the presence of a solvent, like methanol, by means of hydrogen and a hydrogenation catalyst at a temperature between 130° C and 190° C and a pressure of 50 to 100 atmospheres. The aldehyde mixture may also be reduced with hydrogen by means of a hydrogenation catalyst without distillation after removing the hydrogenation catalyst used during the condensation and the nitrogen-containing substances.

The alcohol mixture obtained by the second step of the reaction may be distilled under reduced pressure. The main fraction distills between 90° and 290° C under a pressure of 2 millimeters. These alcohols obtained in a good yield crystallize in part. Upon sulphonation or oxethylation they yield highly capillary-active products, the properties of which are analogous to those of the sulphonates or oxethylation-products respectively of fatty alcohols.

Example 2

875 parts of crotonaldehyde, 150 parts of glacial acetic acid and 125 parts of a chromium-activated nickel catalyst are charged in a stirring autoclave. After deaerating three times by means of nitrogen, 50 atmospheres of hydrogen are pressed in at a temperature of 20° C. From a pressure-vessel communicating with the autoclave 60 parts of piperidine are pressed into the reaction mixture in the course of some hours. At the outset of the condensation the pressure begins to drop, whereas the temperature rises. It is kept at between 35° and 40° C by cooling. After 2 hours the hydrogen pressure is increased to 115 atmospheres, whereupon the temperature is allowed to drop to a slight extent, until the absorption of hydrogen per hour has fallen to one third of the quantity hourly absorbed at the outset of the reaction. The reaction mixture is then slowly heated to 35° to 40° C, whereupon the absorption of hydrogen intensifies. After about 25 hours the condensation is practically finished.

The reaction mixture containing mainly saturated higher molecular aldehydes may be converted into higher molecular alcohols without separating the aldehydes. For this purpose the autoclave is slowly heated to 180° C until no more hydrogen is consumed. The yield of alcohols boiling above 160° C amounts to about 70 per cent of the theory.

RUDOLF KERN

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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF ALICYCLIC KETONES FROM ALICYCLIC ALCOHOLS

Friedrich Laucht, Leuna, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 6, 1940

The present invention relates to the production of alicyclic ketones from alicyclic alcohols.

The preparation of ketones by the catalytic dehydrogenation of secondary alcohols has heretofore been suggested. Thus, vaporized secondary alcohols have been led over copper-zinc alloys, in particular over alloys containing equal amounts of copper and zinc.

In the production of alicyclic ketones with the aid of such catalysts, there is usually observed a too far-reaching dehydrogenation with the formation of phenol and, furthermore, a dehydration with the formation of olefinic bodies. It is very difficult to free alicyclic ketones from phenols. The distillation in the presence of alkali metal hydroxides, which would keep back the phenols, cannot be carried out, because the ketones undergo intermolecular condensations in the presence of alkali metal hydroxides. It is also very difficult to wash out the phenols with dilute alkali metal hydroxide solutions because of the high density of alicyclic ketones. Cyclohexanone may be, it is true, separated from phenol by rectification. This process, however, involves additional expenses; it cannot be used at all when purifying mixtures of cyclohexanone and its homologues because of the overlapping of the boiling points of the ketones with those of the phenols.

It is an object of the present invention to produce alicyclic ketones which are free from phenolic bodies and free from substantial amounts of olefines by carrying out the dehydrogenation at temperatures not substantially exceeding 500° C. with the aid of zinc alone or of zinc containing up to 20 per cent of copper, preferably not more than 15 per cent of copper. According to the present invention there may be used as catalyst zinc alone or zinc being admixed or alloyed with small amounts of copper amounting up to 20 per cent. Small amounts of other ingredients usually to be found in the commercial grades of zinc do not prevent the satisfactory operation of the process.

The invention may be used in the dehydrogenation of monocyclic alicyclic alcohols, such as cyclohexanol and its homologues and mixtures thereof, as they are obtained in the hydrogenation of monocyclic phenols, as well as in that of other alicyclic alcohols, e. g. of decahydronaphthol. The catalysts are used in such a form as to offer a large surface to the gaseous alcohol, while care is taken that the flow of the gases is not hindered. Preferably, the catalysts are used in the form of netting, rolled-up netting, spirals, threads or cuttings.

The vaporized alcohols may be led over the catalyst together with inert diluent gases, as for example with nitrogen, hydrogen or steam. It is preferable to work at normal pressure; however, the process may also be carried out under sub-atmospheric or superatmospheric pressure.

The most favorable reaction temperature depends on the catalyst. Generally speaking, the most favorable reaction temperature may be increased within the range of from about 380 to 500° C. with increasing copper content. While temperatures from about 380 to 390° C. are most favorable in the use of zinc alone, the optimal temperature amounts to about 420° C. for a copper content of 5 per cent, to about 440° C. for a copper content of 10 per cent, and to from about 460 to 480° C. for a copper content of 15 per cent. Other temperatures within the range of from 380° to 500° C. may be used for the various catalysts set forth above without the formation of undesirable by-products, the rate of conversion being somewhat poorer.

Furthermore, it is preferable to avoid temperatures above the melting point of the catalysts because otherwise the surface offered to the alcohol vapors becomes small. When working below 380° C., the rate of conversion decreases, in other words mixtures of alcohols and ketones are obtained which are useful for many technical purposes. Working below 300° C. is no longer economical due to the very slow speed of conversion.

The following eramples will serve to illustrate the nature of this invention. It is, however, not restricted to these examples.

Example 1

1 kilogram of vaporized cyclohexanol per hour is led at 440° C. through a tube made from V2A steel of 2 meters length and 36 millimeters internal diameter which is charged with 1.5 kilograms of turnings of an alloy consisting of 90 per cent of zinc and 10 per cent of copper. The vapors emerging from the tube are condensed. The condensate contains from 90 to 95 per cent of cyclohexanone, less than 1 per cent of cyclohexene, the balance consisting of unchanged cyclohexanol.

Example 2

15 grams of vaporized methylcyclohexanol (obtained by hydrogenation of a mixture of isomeric cresols) per hour are led at 420° C. through a glass tube of 80 centimeters length and 20 milli-

meters internal diameter charged with 40 grams of turnings of an alloy containing 95 per cent of zinc and 5 per cent of copper. By condensing the vapors emerging from the tube a liquid is obtained consisting of from 85 to 90 per cent of methylcyclohexanone, unchanged methylcyclohexanol and less than 1 per cent of methylcyclohexene.

Example 3

1 kilogram of a mixture of 40 per cent of cyclohexanol, 40 per cent of methylcyclohexanol and 20 per cent of dimethylcyclohexanol (obtained by hydrogenating a mixture of phenol, cresols and xylenols) is led per hour at about 390° C. through a tube as described in Example 1 which is charged with 1 kilogram of zinc turnings. By condensing the vapors emerging from the tube, a mixture is obtained which contains from 85 to 90 per cent of alicyclic ketones, unchanged alicyclic alcohols and less than 1 per cent of cyclic olefines.

FRIEDRICH LAUCHT.

Published June 8, 1943 Serial No. 371,843

ALIEN PROPERTY CUSTODIAN

DEVICE FOR CONTROLLING POWER CIRCUITS

Wilhelm Puttfarcken, Berlin-Spandau, Germany; vested in the Alien Property Custodian

Application filed December 26, 1940

This invention relates to a device for controlling power circuits and is characterized by the fact that it comprises a continuously varying resistance lying in a circuit and a power storing device serving to drive and to brake the movable part of the resistance device, the power storing device being arranged in such a manner that it is unstressed, approximately in the center of the control path and acts in the first portion of this path as a driving device and in the second portion thereof as a braking device.

The disconnection is preferably effected in the manner that the resistance of the circuit of a small steady value varies rapidly to a great extent, for which the current is either negligible or may easily be interrupted by a residual current circuit breaker of small interrupting capacity. In the first case the device serves to effect the switching operation and in the second case to initiate the same. In this case the resistor is displaced in the shortest possible time approximately of the order of magnitude of a millisecond from the end position to the other position without mechanically or electrically over-stressing the device. The device according to the invention has proved to be suitable for this purpose. The desired uniform switching operation is ensured by the use of a continuously varying resistor and the speed of actuation mentioned above may be brought about only by means of a power storing device. Since the latter acts both as a driving and braking device, the extremely rapid control motion is brought to a standstill in the end position of the device without an undue pulsating action and without excessive development of heat.

The power storing device drives the movable part of the variable resistor preferably through a multiplication gear. In this manner the disadvantage is seemingly presented that the mass of the gear increases the masses to be moved, so that the speed cannot readily attain the desired high value. Under the present particular conditions the mass of the power storing device saved owing to the use of the multiplication gear is, however, greater than that added by the multiplication gear, since the multiplication gear may be designed as a simple lever, preferably as a single armed lever of a relatively small mass. The power storing device is preferably designed in the form of a spring whose mass is the less important the smaller the travel of the spring. It is the mass of the spring which constitutes the main cause for the inertia in connection with drives operating at high speeds. Consequently, the smaller the travel of the spring resulting from the choice of the gear, the smaller the work of acceleration to be expanded on the spring mass and the more energy is free for the acceleration of the movable part of the variable resistor.

In the accompanying drawing is shown an embodiment of the invention in diagrammatic form. Over a resistor w embedded in the insulating base plate i slides a contact s which in order to effect the switching operation is to be displaced at a high speed in the direction of the arrow c from one end position to the other. The contact is guided in the frame a supported by the base plate i by means of one or more rollers r and is connected through a single armed lever h with the spring f mounted in the frame a. The spring acts on the lever h with small lever arm and must therefore traverse only a short path. The spring has a few windings of large cross-section. In this manner the natural frequency of the spring may assume such a high value that no disturbing influences occur at the required speed at which the movement is effected. To this end, the half period of the natural vibration of the spring is preferably made smaller than the duration of the control motion. The tension of the spring may be regulated by rotating the bolt e.

In order that the parts of the device do not come into engagement with one another under sudden blows at the end of the movement the drive is so arranged according to the invention that the spring is unstressed in its central position and acts in the first portion of the control motion as a driving spring and in the second portion thereof as a braking spring. The movable contact s or the drive is latched in the end position by a catch k_1 or k_2 which must be released again in order to initiate the next control motion. In several cases the latching in the end position is sufficient so that the other catch may be dispensed with.

The resistor may also be periodically adjusted. The spring must be stretched at the end of each control motion either by hand or with the aid of any known drive, for instance, of an electromagnet or a compressed air piston.

Instead of the helical spring f shown in the drawing also a resilient rod may be employed which is in engagement with the pin b of the lever h. Also in this case the force of the spring is transmitted to the movable part of the device with a great ratio. The resilient rod has the advantage that its inertia is very small.

WILHELM PUTTFARCKEN.

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JUNE 8, 1943.
BY A. P. C.

W. PUTTFARCKEN
DEVICE FOR CONTROLLING POWER CIRCUITS
Filed Dec. 26, 1940

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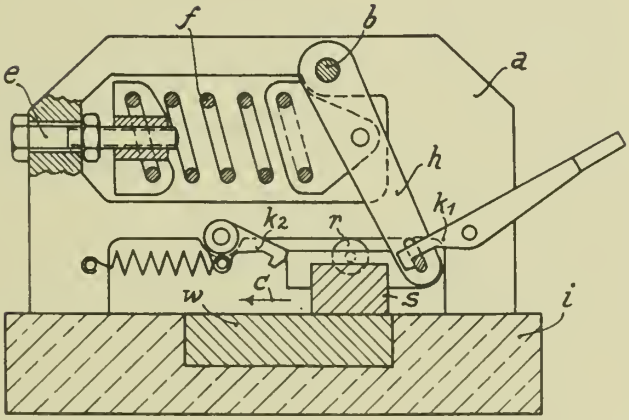


Inventor
Wilhelm Puttfarcken
by Knight Bros
Attorneys

Published June 8, 1943 Serial No. 373,839

ALIEN PROPERTY CUSTODIAN

COMPRESSION OR DEPRESSION PUMPS OF THE LIQUID RING TYPE

Robert Léon Dardelet, Grenoble, France; vested in the Alien Property Custodian

Application filed January 9, 1941

My invention is directed to rotary depression and compression pumps for gases (vacuum pumps and compressors) of the liquid ring type, that is to say comprising, inside a body containing a quantity of liquid, at least one rotor having displacement recesses and rotating with the least possible clearance in contact with one or a plurality of stationary circular surfaces called distributors provided with suction and delivery openings, formed by one or a plurality of ports, for the passage of the gases which are respectively sucked from and delivered into the compartments or recesses formed between the blades by the rotating liquid ring formed under the action of centrifugal force and following the internal contour of said body formed with at least one lobe.

It has been found that in such pumps, a given angular position of the origin of the delivery opening or openings in the direction of rotation of the rotor is only suitable for a definite rate of operation, that is to say for a definite delivery pressure or for a definite vacuum. When a pump whose distributor is suitable for a certain rate of operation operates at a different rate, the communication between the delivery openings and the recesses of the rotor is effected too soon or too late. This produces overpressures that increase the power absorbed by the pump and disturb the operation.

An object of my invention is to enable a gas pump of the liquid ring type to be used for a whole scale of rates of operation while keeping the efficiency at its highest value and without any adjustments being required.

A further object of my invention is to provide a gas pump of the liquid ring type in which the angular position of the origin of the or of each delivery passage open to the gases carried along by the rotor, automatically varies according to the rate of operation to which it automatically adapts itself.

A still further object of my invention is to provide in a pump of the above character, a delivery passage at least the origin part of which is provided with a valve arrangement mounted to only allow the gases coming from the recesses of the rotor to pass when their pressure exceeds the delivery pressure of the gases.

According to an embodiment of my invention, the delivery opening or each delivery opening of the distributor is formed by a number of elongated elementary ports spaced in the direction of the rotation of the rotor, and with at least one part of which there co-operates a rod-shaped valve which is kept in register with said opening by a guiding device and is directly exposed to the delivery pressure of the pump.

These longitudinal ports are continuous or are formed by a row of holes or the like.

According to another embodiment of my invention, the delivery opening or each delivery opening of the distributor is at least partly closed by at least one valve, which is elongated in the direction of the rotation, which is made of flexible material, in such a manner as to uncover a more or less great length of the opening with which it co-operates, according to the pressure to which it is subjected.

Said valve may be free, but is preferably fixed at one of its ends on the distributor and co-operates with abutments that limit its movement.

The delivery opening or openings may in this case be continuous or be formed by elementary ports which are preferably spaced in the direction of the rotation of the rotor. Each of said openings may, moreover, comprise a plurality of parts, each of which is conjugated with its own valve.

Other features, objects and advantages of my invention will moreover become apparent from the ensuing description made with reference to the accompanying drawings which are given solely by way of example and in which:

Fig. 1 is a sectional elevation of a liquid ring air pump;

Fig. 2 is a partial similar view, on a large scale, showing the arrangement according to the invention;

Fig. 3 is a section along the line III—III of Fig. 2.

Fig. 4 is a similar view to Fig. 2 and relates to a modification.

Fig. 5 is a section along the line V—V of Fig. 4;

Fig. 6 is a similar view to Figs. 2 and 4, and relates to another modification.

Fig. 7 is a section along the line VII—VII of Fig. 6;

Figs. 8 and 9 are detail views of modification of Fig. 7.

In order to facilitate the explanation and in a nowise limitative manner, all these figures relate more particularly to a pump with a single rotor and with an internal distributor and with two lobes formed in the pump body. Said pump comprises, referring to Fig. 1, an elongated body 1 including a pump chamber having enlarged portions or lobes at opposite sides, the major axis of said chamber being vertical. The rotor 2 which is provided with blades 3 and in the

medial part of which are fitted one or a plurality of distributors 5 provided with suction openings 6 communicating with the suction pipe 7 and with delivery openings 8 communicating with the discharge pipe 9.

A quantity of liquid contained in the body 1 forms a liquid ring 10 following the internal contour of the pump chamber by the action of centrifugal force and when the rotor 2 rotates in the direction of the arrow *f*. Said ring represents a piston in each recess formed by the blades 3, and produces the suction and the delivery through the openings 6 and 8 of any desired gas.

According to the embodiment shown in Figs. 2 and 3, the delivery opening 8 is formed by a number of elementary longitudinal ports 8*a*, 8*b*, 8*c*, 8*d*, 8*e*, 8*f*. Said ports are elongated in the axial direction and are spaced apart from each other in the direction of the arrow *f*. They are shown as being continuous, but could, of course, be formed by a plurality of holes or openings.

Each of the ports, save the last one 8*f* in the direction of the arrow *f*, co-operates with a valve formed by a rod 10*a*, 10*b*, 10*c*, 10*d*, 10*e*, of cylindrical or other shape, the diameter of which is greater than the width of the co-operating port and which is arranged on the inner side of the distributor. Said rods may be of any suitable cross-section and are made of flexible material such as rubber, or again they are rigid, for example made of steel, cuprous metal, glass, stoneware or other material.

Guides 12, 13 and 14 respectively embrace said rods at their ends and at their central part with a clearance that enables them to move between their operative position in which they close the co-operating ports and a position that uncovers said ports.

It will be understood that the retaining valves thus formed remain closed as long as the pressure in the distributor is higher than the pressure in the recesses formed between the blades, with which recesses said valves are in contact. This latter pressure increases in the direction of the arrow *f* owing to the action of the liquid ring 10 so that the valve 8*d* which is opposite a recess of the rotor in which the pressure reaches this delivery pressure, opens as well as those following it in the direction of the arrow *f*. The position of the first valve opened varies according to the rate of operation of the air pump, and no substantial overpressure can occur.

According to the embodiment shown in Figs. 4 and 5, the valves 10 are replaced by a single deformable valve 15 which is elongated in the direction of rotation *f* of the rotor and is capable of covering the ports 8*a* to 8*e* inclusive. Said valve 15, which is formed by a strip of rubber or of flexible metal, is fixed by a screw 17 on a fixing member 18 before the ports 8 in the direction of the arrow *f*, and its opening travel is limited by abutments 19 fixed inside the distributor.

It will be understood that said valve 15 is deformed, as shown in dotted lines, and uncovers the ports 8 more or less according to the rate of operation of the pump, as explained in connection with the above example.

Referring to Figs. 6 and 7, the delivery port or ports, such as 20, are elongated in the direction of rotation *f* so as to permit the maximum opening of the gas passage. Said port 20, the cross-sectional width of which decreases as it is more remote from the axis, co-operates in this case with a deformable valve 15 of the same shape for which it acts as a housing and which is held at its upper end in the direction of the arrow *f* by a screw 17 on a transverse stop member 18 fixed to the distributor.

Abutments 19 limit the opening travel of this valve 15 which is effected over a more or less great length according to the rate of operation of the pump.

Absolute progressiveness is thus obtained.

The cross-section of the opening 20 may be provided with a shoulder as shown in Fig. 8, the valve 15 being in this case of corresponding shape.

The valve 15 may be made of flexible material and be reinforced with transverse metal bars 21, as shown in Fig. 9.

While I have specifically described forms that my invention may assume in practice, it will be understood that these forms have only been given by way of example and it is obvious that my invention is applicable to any construction of liquid ring compression or depression pump for gases, whatever be the shape of the distributors and the number of rotors.

ROBERT LÉON DARDELET.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

R. L. DARDELET
COMPRESSION OR DEPRESSION PUMPS
OF THE LIQUID RING TYPE
Filed Jan. 9, 1941

Serial No.
373,839

Fig.1.

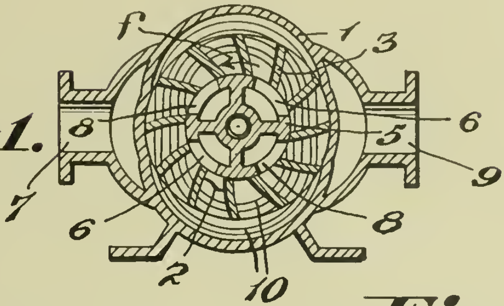


Fig.2.

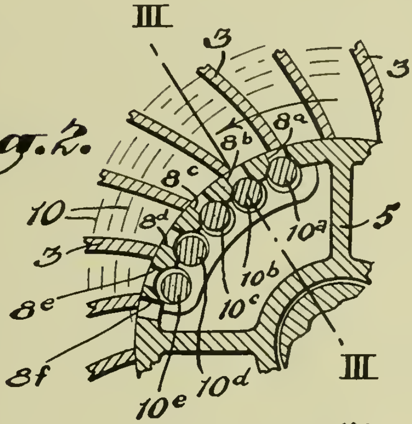


Fig.3.

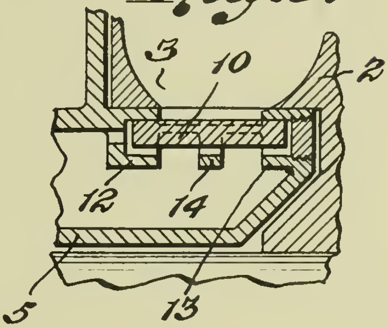


Fig.4.

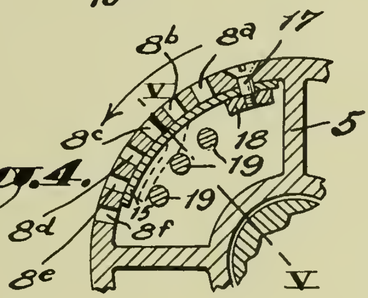


Fig.5.

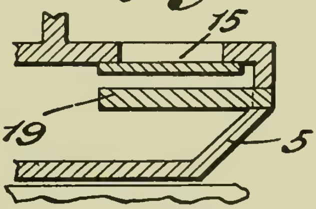


Fig.7.

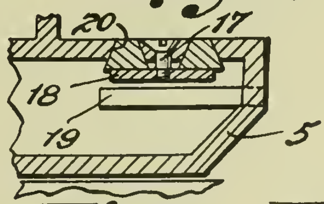


Fig.6.

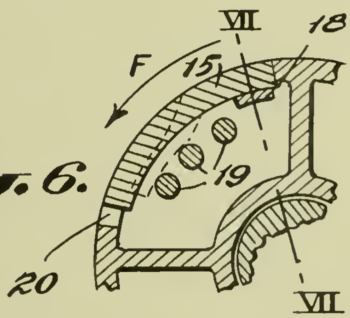


Fig.8.

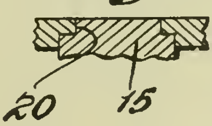
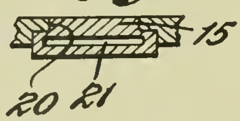


Fig.9.



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ALIEN PROPERTY CUSTODIAN

CONTROL MECHANISMS FOR LOWERING FLAPS AND HYPER-LIFTING DEVICES FOR AIRCRAFT

Charles Raymond Waseige, Rueil, France; vested in the Alien Property Custodian

Application filed January 24, 1941

The present invention relates to a control mechanism for lower wing flaps and similar hyperlifting devices for aircraft.

The object of the present invention is to actuate flaps or other hyperlifting devices by a motor connected to a torque limiting device.

A further object of the invention is to provide a motor actuating, through a transmission in which is inserted a torque limiting device, one or several moving control means which can be coupled to the flaps, or to the other hyperlifting devices.

Another object of the invention is to provide a motor connected with and actuating flaps or other hyperlifting devices through a transmission one part of which, between the motor and the torque limiting device, being practically nonreversible, the other, between the torque limiting device and the said moving control means being reversible.

A still further object of the invention is to obtain a simultaneous and equal effacement of all flaps or same, without affecting the part of the transmission placed between said motor and said torque limiting device, when they are actuated or being actuated, and when a squall applies on them a total thrust superior to the thrust for which the limiting device has been set, whatever be the effect of the thrust due to the squall upon each of the flaps separately.

The part of said transmisison between the torque limiting device and the moving flaps controlling means is preferably designed so that the transmission quotient be the same in all the positions of the flaps.

A further object of the invention is to provide a control mechanism as a self-contained independent unit comprising a motor, generally an electric motor, one or several controlling means connected to said motor through a speed limiting device and a torque limiting device, and coupling means between said moving parts and the different flaps to be actuated.

Said moving control device, or each of same may be formed, either by alternating moving means comprising for instance a rack meshing with a gear at the end of said transmission, or a rotating axle which can be directly connected to an axle rotating with the flaps or other hyperlifting devices which are to be actuated by the first rotating axle.

In accordance with an embodiment of the invention, only one moving control device is provided, and comprises two coupling devices through which it can be connected to the lower wing flaps or other which it has to control, situated on the wings, respectively on each side of the fuselage.

In accordance with another important embodiment of the invention, which can be separately used, the mechanism comprises two moving control devices actuated simultaneously by the same transmission preferably comprising said torque limiting device, and joining their motions, each of these devices being coupled to the lower wing flaps or other hyperlifting devices situated on one side of the fuselage.

It is advantageous to provide an angle between these two devices, so that they be parallel to the wings of the airplane, said wings forming generally an dihedral angle and sweeping back so that the coupling between the flaps or other and the devices is made easy.

According to the last mentioned embodiment, the part of the mechanism connecting with the flaps is preferably made of two control devices with rectilinear alternating motion, each of which can be coupled to a sliding rod placed alongside the corresponding wing, connected by links to the flap or flaps to be controlled, such design being a part of the invention.

It is also advantageous to combine the moving device, or devices to which the flaps are connected, with a device stopping the motor when it comes at least to a predetermined position, in order to precisely bring the flaps or other to any desired position.

To that effect and, according to another characteristic which is also an object of the invention, at least one switching device permitting to cut off the motor part of the mechanism cooperates with one or several parts moving with reference to said motor, according to the displacements of the moving part of the mechanism, in order to control said switching device and stop the motor for one or several predetermined positions of said moving part.

Moreover, one actuating device may cooperate with several switching devices, which it controls for different positions of the moving part, one or the other being at will on circuit.

Considering the switching device and its actuating part together, one of them is not bound to the motion of the moving control part, and it is generally the switching device. That element which is not bound to the motion of the moving control means is advantageously designed so that its position can be regulated at will, by a hand controlling device, in order to modify the stopping position of the flaps. The other element, which is bound to the motion of the moving con-

trol means, generally the device actuating the switching device, can be geared by the moving control means, or moved by it directly through a cam, or indirectly.

In an advantageous embodiment, two switching devices connected to the circuit of the motor to control the rotation respectively in both ways, are fixed upon a common support, the position of which can be regulated with respect to an element movable according to the displacement, with reference to said support of the moving control device, said element being designed so as to actuate either one or the other switching device when it moves with reference to said support in one or the other way from a determined position, and as a result the position of the moving device is related to that of said support.

Said moving element is for example a pulley concentrically to which is fixed said support in such a way that its angular position can be regulated.

In the accompanying drawings, different embodiments of the invention have been illustrated by way of examples only:

Fig. 1 is a cross section along the axle of the motor in an embodiment of the invention.

Fig. 2 is a cross section along line II—II of the Fig. 1.

Fig. 3 is a plane view of the embodiment according to Fig. 1 and Fig. 2.

Fig. 4 is a partial elevation of the embodiment according to Figs. 1 to 3.

Fig. 5 is a partial elevation similar to Fig. 4 showing a modification of the automatic stopping device.

Fig. 6 is a partial cross-section similar to Fig. 1 showing another embodiment of the same system.

Fig. 7 is a partial cross-section along line VII—VII of Fig. 6.

Fig. 8 is a front view of a modification of the embodiment according to Fig. 6.

Fig. 9 is a cross-section along line IX—IX of Fig. 8.

Fig. 10 is a partial view of the embodiment according to Fig. 6 with the modification according to Fig. 8.

Fig. 11 is a cross-section along the axis of the motor according to another embodiment of the invention.

Fig. 12 is a partial cross-section similar to Fig. 1 of another embodiment.

Fig. 13 is a front elevation, with several parts being represented in cross-section.

Fig. 14 is a schematic elevation showing the adaptation on an airplane of the mechanism according to the embodiment shown on Figs. 11 to 13.

Fig. 15 is a schematic plan view of the adaptation according to Fig. 14.

In the embodiment represented on Figs. 1 to 4, the flap control device for the moving flaps is a rack **1**, prolonged by cylindrical bearings **2** sliding inside of a part of casing **3** from which they project and terminated by threaded bearings **2'** for the fixation of the connecting ends **4**, binding them to the flap controlling rods. A roller **6** is mounted at the center of casing **3** with an additional plate. The roller **6** comprises a groove **7** of cylindrical cross-section which supports the back side, of circular cross-section, of the rack **1**. The rack **1** meshes with a gear **9** secured to the part **3** of the casing. The shaft **10** projects outside of said part **3** of the casing, which has its plane of junction perpendicular to the axis of said shaft, and on which is secured another part **12** of said casing, prolonged by a third part **13** containing a motor **14**, which in case of Fig. 1 is an electromotor. The shaft **16** of this motor is coaxial with shaft **10**, and carries a clutch coupling device **17** engaging a corresponding element **18** journaled in a partition **19**, said partition being placed between the contacting faces of the two parts **12** and **13** of the casing. This element **16** is secured to a gear **20** meshing with a gear wheel **21**, freely rotating on a shaft which forms the hub of a gear **22** and is journaled at one end in partition **19** and at the other in a web **23** projecting on the inside of the part **12** of the casing. The wheel **21** is secured to a gear **24** meshing with a wheel **25** coaxial with shafts **10** and **16** and secured to a shaft **26** and to a gear **27** said gear meshing with a wheel **28** freely rotating on a shaft which forms the hub of a gear **22'** exactly similar to gear **22**, both gears **22** and **22'** being equally distant from the common axis of shafts **16** and **10**. Said wheel **28** is secured to a gear **30** meshing with a wheel **31** freely rotating on shaft **26**, and secured to a gear **32** meshing with the two wheels **22** and **22'**. Said wheels **22** and **22'** together with two exactly similar wheels are placed around the general axis, all these wheels meshing with one large wheel **35** having an interior gearing, the wheel **35** rotates freely on one end of shaft **26**, the other end of which is freely supported by a bearing of the coupling device **18**. The centering and balancing of the whole device are therefore obtained by gears **22** and **22'**. Wheel **35** is secured to a pinion **37**, which is the planetary wheel of an epicycloidal gear comprising satellites **38**, supported by axles mounted on a plate **39** rigidly secured to shaft **10**, and an exterior planetary wheel **41**. Said wheel **41** is connected to casing **12** by a friction coupling device comprising disks **42** axially sliding inside of peripherical grooves of said wheel **41**, and disks **43** axially sliding inside of a sleeve **45** secured to an exterior rim **46**, situated between the contacting faces of the parts **3** and **12** of the casing. These disks **42** and **43** are pressed together and abutted on an annular inside brim **47** of sleeve **45** by helical springs **48** placed around a circle, and situated between the collar **49** of a sliding sleeve **50**, and another plate **51** screwed in an interior thread of the sleeve **45** and sliding inside of grooves **52** of said sleeve **50**. These grooves **52** mesh with a pinion **53** mounted on an axle **54** which extends through the casing and projects outside of same where it terminates by an element which may be actuated by means of a wrench or the like. It is evident that by rotating this axle **54**, the sleeve **50** is rotated through the means of pinion **53** and grooves **52** so that the plate **51** is screwed into or out of sleeve **54**, and compresses more or less the springs **48**, which permits the adjustment of the value of the torque for which the clutch starts its sliding action.

Outside and at each end of casing **3** is mounted a switch **58**, **58'** connected to the feeding circuit of the motor so as to cut off said circuit when actuated. Each switch **58**, **58'** is actuated by fingers **59**, **59'** pivoted on an axle **60**, **60'** secured to casing **3** and integral with a cam **61**, **61'** cooperating with an abutment **62**, **62'** mounted on the projecting part of rack **1**. The two switches respectively stop the motor for the two terminal positions of the rack **1**.

Furthermore, another switch **65**, secured to the casing cooperates with a pinion **66** pivoted on axle **60** and bearing a cam **67**. Said cam is actuated

by the abutment 62 when same reaches the position indicated in dotted lines in Fig. 4.

The contacting device 65 is closed when it is desired to stop the motion of rack 1 at the intermediate position defined by cam 67, cooperating with the abutment 62 and corresponding to a determined angular position of the flaps. This stopping may be controlled when the rack is moved in one or the other way corresponding to the opening or effacement of the flaps.

Other switches may be provided to define other intermediate positions of rack 1.

The working is as follows:

When motor 14 is rotated in one or the other way corresponding to the opening or to the effacement of the flaps, the rotation of its shaft 16 is transmitted by the coupling device 17, 18 and the demultiplicating gear 20, 21, 24, 25, 27, 28, 30, 31, 32 and 22 to wheel 35 integral with the planetary wheel 37. If the resisting torque upon planetary wheel 41 is inferior to the torque producing the sliding of the coupling device 42, 43, 44, 45 which forms the torque limiting device, said wheel 41 remains motionless, and the satellites 38 rotate around it and produce the rotation of shaft 10, which rotation is transformed by pinion 9 and rack 2 into a sliding motion of said shaft.

This motion goes as far as the contact between the abutment 62 and the cam 67, when the switch 60 is closed, or as far as the contact of said abutment and one of the cams 61, 61′, depending upon the way of rotation of the motor.

If the resisting torque which acts upon the wheel 41 is superior to the torque producing the sliding of the coupling device 42, 43, 44, 45, said coupling device slides, and wheel 41 rotates instead of remaining motionless. This motion is not transmitted to that part of the mechanism situated between the limiting device and the motor, said part being nonreversible. Such a torque is produced for instance in the case of a squall exerting too big a stress upon the flaps being actuated. As soon as the resisting torque becomes a new inferior to the friction torque of the coupling device, either as a result of the effacement of the flaps, or as a result of the lessening of the intensity of the squall, planetary wheel 14 stops, and the motor may again drive shaft 10, the stopping of the motor depending only upon the position of rack 1.

Furthermore, the same torque limiting device permits the effacement of the flaps when a squall stresses upon them at any moment when they are actuated.

It is advantageous to have the flaps cooperating with a potentiometer, permitting the distance reading of their angular position.

The various embodiments which will be described with reference to Figs. 5, 6, 7, 8, 9 relate only to methods for stopping the motor for a determined position of the moving element 1.

With reference to Fig. 5 the switch 65 is fixed upon a slide 70 bearing also the articulated axle 60 of finger 66 and cam 67 which are integral and cooperate with abutment 62. This slide moves along a guiding groove 72 which is parallel to the way of motion of rack 1. The sliding motion of slide 70 is obtained by a control rod 74 which may be actuated by the pilot and enables same to define any stopping position of rack 1. The switches 58, 58′ as above described may in this case be dispensed with.

In the embodiment shown on Figs. 6 and 7, the stopping of rack 1 is controlled by a single switch the casing 80 of which may slide perpendicularly to the motion of said rack in a recess 81, provided in the casing 3. The position of casing 80 in its recess 81 is defined by a control rod 83 remotely controlled by a lever 84. The switch is actuated by a rod 86 integral with a plate 87 made of conducting material, and movable between two opposed couples of contacts 88 and 89, both contacts in each couple being separated by a short distance.

The two contacts of each couple are connected with the feeding circuit of the electric motor actuating the mechanism so that their short-circuiting by plate 87 produce the rotation of the motor in one or the other way, respectively.

The rod 86 projects inside the casing 3 and is driven towards there by a spring 91 supported by a widening of said rod at the bottom of casing 80. The end of said rod is contacting the bottom of a groove 92 acting as a cam, provided in rack 1 and having a variable depth along said rack.

It is understood that the displacement of lever 84 in one way or the other when the plate is situated between the couples of contacts 88 and 89, short-circuits one or the other of these couples of contacts, and starts the motor in the corresponding way. Rack 1 is therefore moved in the way corresponding to the displacement of rod 86 towards the inside or the outside, depending upon which of the couple of contacts 88 or 89 have been short-circuited, so that plate 87 is driven back to its median position and cuts off the motor. To each position of lever 84 corresponds therefore one position of rack 1, and consequently one well defined angular position of the flaps.

According to still another embodiment shown on Figs. 8, 9, 10 a pulley 95 having an axle 96 is connected by means of cables 98 with the rack 1 in such a way that its angular position be under the dependance of the position of said rack 1. The periphery of the pulley comprises two continuous ridges 99 and 100 provided side by side and extending respectively over about 180 degrees, leaving a little angular space between their ends.

A support 104 pivoting around the axle 96 of the pulley bears a control handle 106 and may be fixed in any angular position by means of a lock 108 actuated by a lever 109 and cooperating with the rack 110.

The support 104 bears two switches 112 and 113 which are situated in front of the ridges 99 and 100 respectively, the closing of said switches controlling the rotation of the motor of the mechanism in one or the other way respectively.

It is evident that one or the other of the two switches 112 and 113 is always actuated by the corresponding ridge 99 or 100, as long as the pulley is not, with reference to the support, in the angular position called "neutral position", in which the space left between the ends of the ridges is in front of the two switches and in which position the circuit of the motor is cut off.

Under these conditions, the displacement of the support 104 in one or the other way from said neutral position always closes one of the switches, thus producing the rotation of the motor in the corresponding way until the pulley resumes, with reference to the support, said neutral position. Therefore, the position of the rack 1 is related to that of the support 104.

According to the embodiment shown on Fig. 11, the movable control element of the flaps is a

tubular rotating axle 1, both ends of which have interior threads, receiving ending elements 4 which are to be connected directly with the axles of the flaps respectively provided on both sides of the fuselage. The axle 1 is journaled in ball-bearings 6 mounted in part 12 of the casing onto which is secured another part 13 of the casing, which is itself prolonged by a third part 14 of the casing, the last mentioned part enclosing an electromotor. The shaft 16 of said motor drives, by means of a centrifugal clutch 17, a sleeve 18 journaled in a partition 23 placed between the contacting faces of the two partial casings 3 and 12. The sleeve 18 is prolonged by a shaft 19, integral with a pinion 20 meshing with pinions 21, mounted for free rotation on axles 24, said last mentioned pinions meshing with an internal gear 26 provided on a partition 27 which is situated between the contacting faces of the partial casing 3 and 12. The pinions 21 comprise a second gear meshing with an interior geared wheel 28, the axle 29 of which is journaled in a partition 30, integral with the interior face of the partial casing 3. A pinion 32 is secured, by means of grooves, on said axle 29, and meshes with a pinion 33 integral with the outer body 34 of a torque limiting device concentrical with the shaft 4 and comprising disks 36. One series of disks 36 of said torque limiting device is assembled by means of outside grooves of the body 34 and the other series is assembled by inner grooves of said shaft 1, in order to transmit the motion between the body 34 and the shaft 1. The disks 36 are pressed against each other by equally pressing springs 38, abutting on a washer 39 held by a nut 40, screwed on the shaft 1 and allowing the adjustment of the tension of the springs, and therefore of the sliding torque of the limiting device.

It is evident that the rotation of the motor in one or the other way controls the rotation of the shaft 1 in one or the other way, and, consequently, the actuating or the effacement of the flaps, the torque limiting device having the same function as in the already described embodiment. The stopping of the flaps in any position may be obtained as already described in the foresaid embodiment.

The other embodiment represented in Figs. 12, 13, 14 and 15 differs from that described with reference to Figs. 1, 2, 3 and 4, only by the design of part 3 of the casing, the design of the mechanisms it comprises, and the design of the device connecting the mechanism to the flaps. Following description is limited to said points.

With reference to Figs. 12 and 13, shaft 10, supported by bearings 11 and driven by the motor together with a demultiplication gear, as formerly described with reference to Fig. 1, comprises two parallel series of teeth 100 and 100'. Each series comprises a small number of identical teeth, for instance four of them, the sides *f* of which are cylindrically shaped, perpendicularly to the axis of shaft 10, or else receive a similar shape, to facilitate their manufacture. The ends *s* of these teeth are spherical surfaces.

Two identical pinions 9 and 9', with external gearing, the internal cylindrical surface of which surrounds the horizontal shaft 10, are respectively meshing with the series of teeth 100 and 100' with their teeth 101 and 101' which are in equal number but have a greater length in a direction parallel to that of the axis of the shaft 10. Metallic washers 102 and 102', elastically secured in both sides of each gearing 101 and 101', limit the relative movements of pinions 9 and 9' on the shaft 10, these relative movements of pinions 9 and 9' being rendered possible by the shape of sides *f* and ends *s*. A rack 1 is meshing with pinion 9 and is supported on its back side with circular cross-section, by a cylindrical roller 6 secured to the lower part of casing 3 by means of an additional plate. In a similar way, a rack 1', meshing with the pinion 9', comprising a circular cross-section back side, is contacting a cylindrical roller 6' secured to the upper part of casing 3.

Racks 1 and 1' are projecting from both sides of casing 3 which comprises openings for that purpose, the tightness being insured by means of bellows 105, 105' secured between the edges of the openings and the corresponding rack. There are four bellows, i. e. two, 105, cooperating with rack 1, and two, 105', cooperating with rack 1'.

The two racks bear, one on one side of casing 3, the other on the other side, an end 4, which is to be coupled with the lower wing flap control device. To that effect, shaft 10 being parallel to the longitudinal axis of the aircraft, racks 1 and 1' are parallel to the wings which have as well a dihedral angle as back sweeping.

This direction, which is rendered possible by the gears connecting pinions 9 and 9' to the shaft 10, is represented in Figs. 14 and 15 showing the whole design respectively in half-plan, the wing beam being drafted in dotted lines *l*, and in half-elevation, the part corresponding to the other wing being symmetrical.

The flaps are actuated on each wing by a sliding rod 110 directly coupled with the corresponding rack 1, and situated in the prolongation of said rack. This rod is connected by links 111 to the nonfigured flaps, the dotted line position of the link, in Fig. 15, corresponding to the actuated flap.

The flaps placed on each wing could be actuated by two moving devices, moving simultaneously in opposed directions under control of a mechanism quite different from a mechanism described with reference to Figs. 12, 13, 14 and 15.

Obviously, one wheel such as 9 may be provided with helical teeth and cooperates with two racks such as 1 and 1', Fig. 12.

While I have illustrated and described preferred forms of construction for carrying my invention to effect, this is capable of variations and modifications without departing from the spirit of my invention.

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CONTROL MECHANISMS FOR LOWERING FLAPS AND HYPER-LIFTING DEVICES FOR AIRCRAFT

Filed Jan. 24, 1941

Serial No. 375,866

5 Sheets-Sheet 1

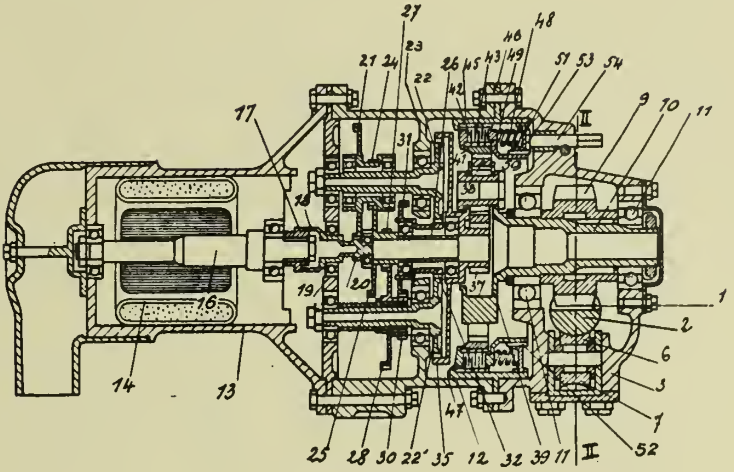

Fig: 1

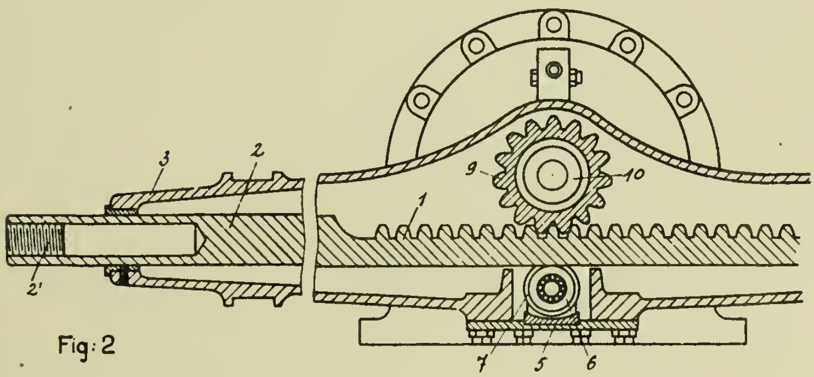

Fig: 2

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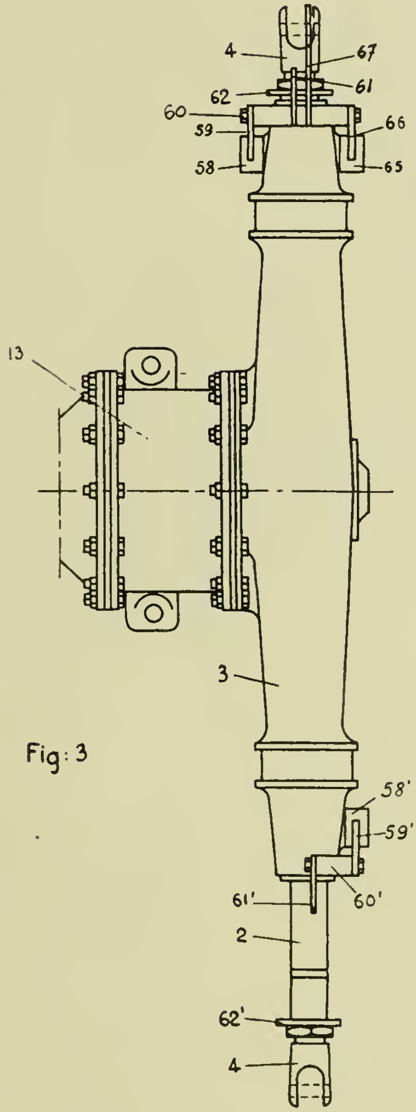

Fig: 3

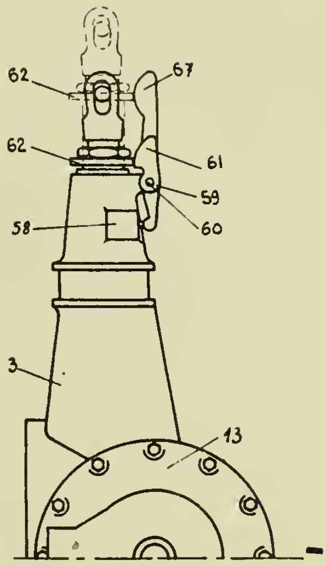

Fig: 4

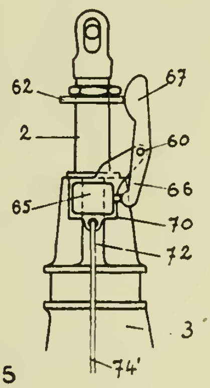

Fig: 5

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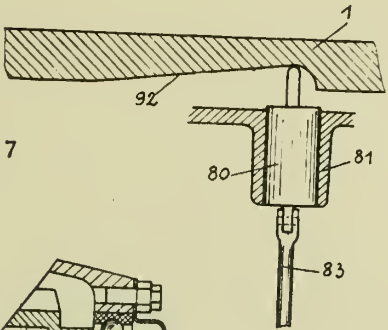

Fig: 7

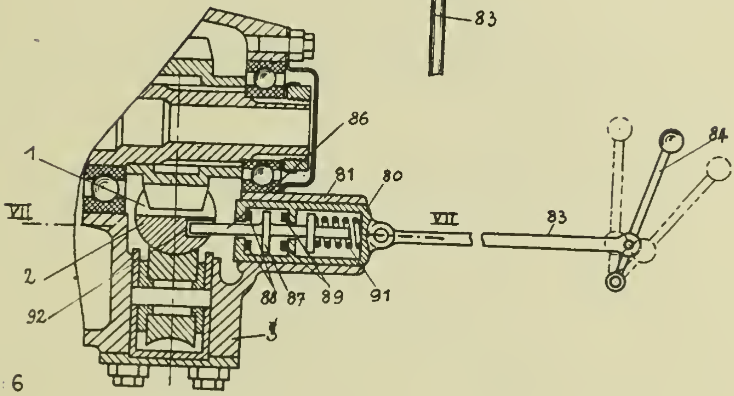

Fig: 6

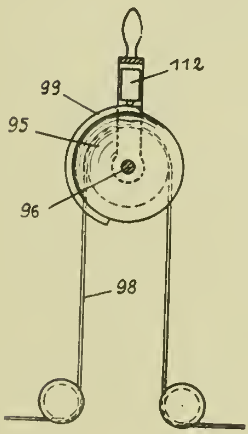

Fig: 9

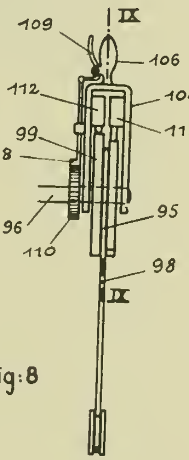

Fig: 8

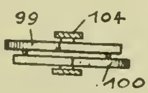

Fig: 10

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5 Sheets-Sheet 4

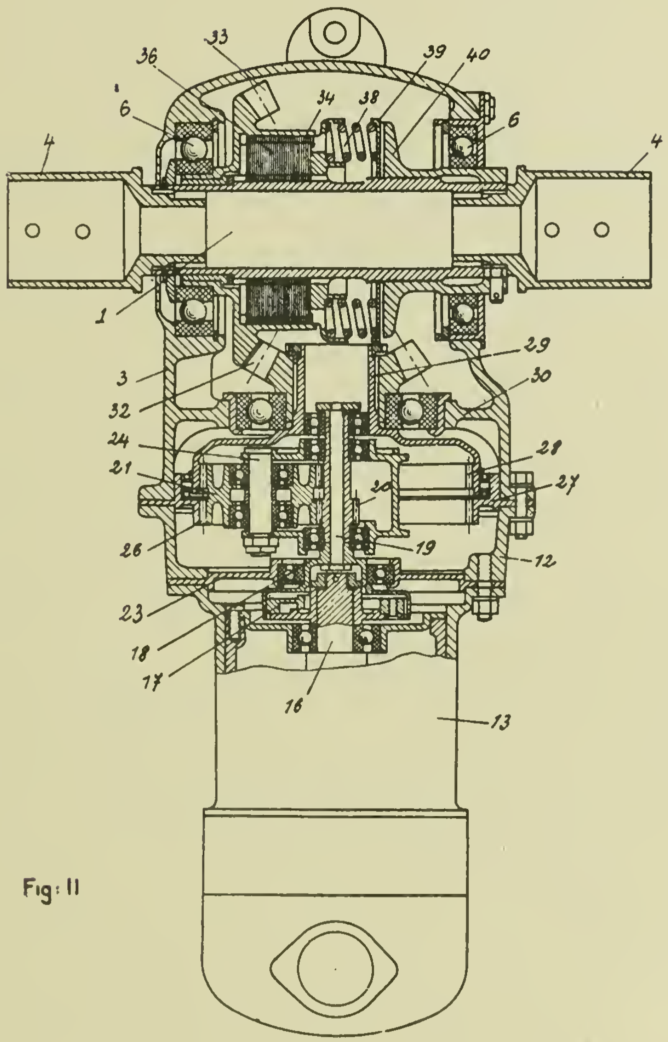

Fig: 11

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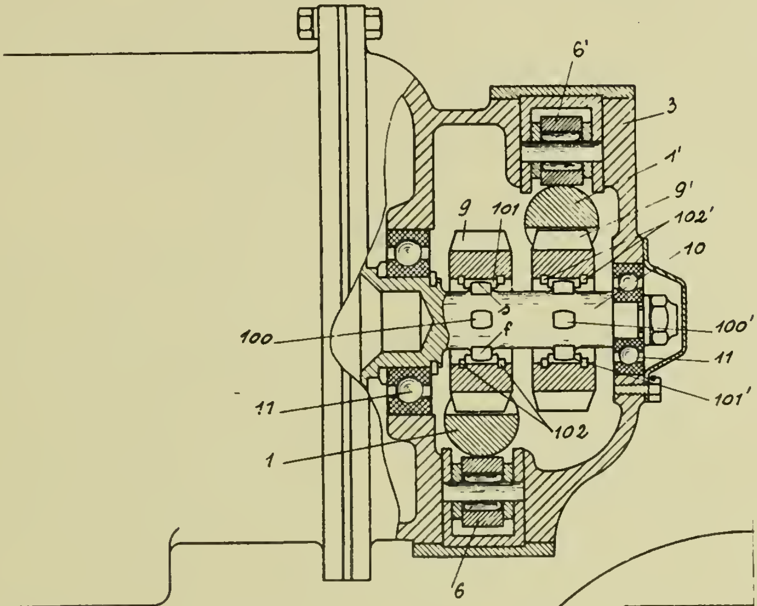

Fig:12

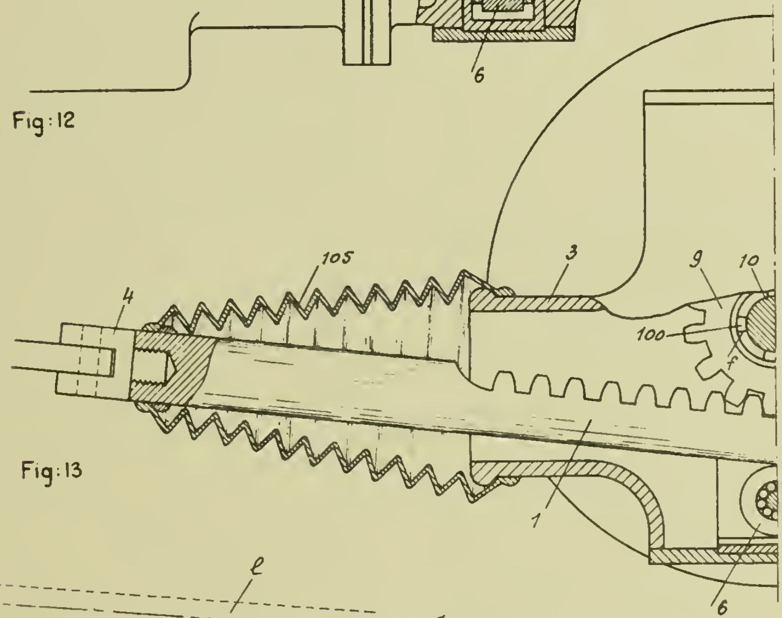

Fig:13

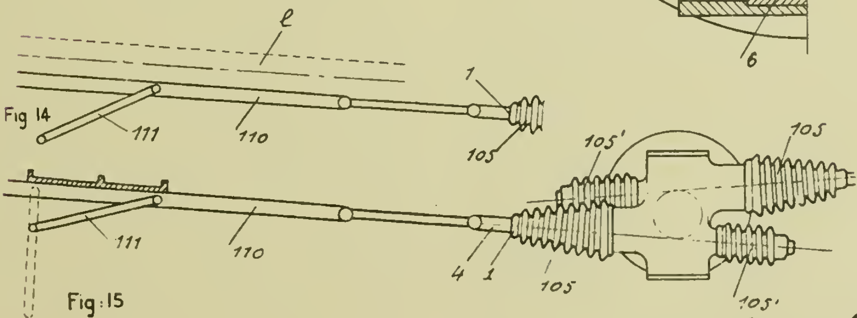

Fig 14

Fig:15

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Attys.

Published June 8, 1943 Serial No. 376,310

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR TAKING PICTURES OF THE IMAGES PRODUCED BY THE ELECTRON OPTIC APPARATUS

Heinz Otto Müller, Berlin-Spandau, Germany; vested in the Alien Property Custodian

Application filed January 28, 1941

This invention relates to an apparatus for taking pictures of the images produced by the electron optic apparatus.

In electron optic apparatus, particularly in electronic microscopes, devices are necessary, by means of which pictures of the images produced by the apparatus may be taken. It is, for instance, known in the art to arrange the photographic plate in electronic microscopes in such a manner as to be exposed to the electron rays.

The object of the present invention is to provide a means, whereby the entire surface of the photographic plate is uniformly influenced by the electron rays for a time capable of being adjusted accurately. A fluorescent screen which may be removed from the path of rays by rotation has hitherto been employed in electronic microscopes as a means for influencing the photographic plate. This method has the disadvantage in that the photographic plate is not uniformly influenced by the fluorescent screen. The parts of the photographic plate which lie nearer the pivot of the screen are exposed for a shorter time. Furthermore, it is not possible to attain a sufficienly accurate adjustment of the exposure time, since the shutter is hand-operated. This is particularly the case when employing highly sensitive plates. In this case shorter exposure times must be then chosen, which can no longer be maintained in such a simple manner by hand. When moving the fluorescent screen away from a path of rays, serving to determine the exposure time vibrations which impair the production of a sharp image may easily be set up.

The above-mentioned drawbacks are removed according to the invention by means of a known shutter arranged within the vacuum vessel in the path of the electron rays and which may be set as to the exposure time and released with the aid of actuating means passing through the vacuum wall. In this manner it is possible to uniformly influence the entire surface of the photographic plate by means of the electron rays for a time capable of being accurately adjusted. Besides also high sensitive plates may readily be employed which have the advantage that the sharpness of the image is improved owing to the shorter exposure times which may be chosen. In the apparatus according to the invention a mechanical shutter is employed in the vacuum chamber, the shutter being operated preferably exteriorly of the vacuum vessel with the aid of actuating means cooperating with sealing cones. A slit shutter or also a central metal shutter may be used. In order to release the shutter a mechanism is employed to advantage which is actuated with the aid of the fluorescent screen. The releasing device is, for instance, so designed that the fluorescent screen actuates the releaser after the screen has been moved away from the path of rays by rotation. To facilitate the adjustment a pointer and a scale are allotted according to the invention to the actuating means serving to adjust the exposure time and which is arranged exteriorly of the vacuum vessel.

In the accompanying drawings is shown an embodiment of the invention in diagrammatic form, in which

Fig. 1 is a top view of a slit shutter and its actuating means;

Fig. 2 is a sectional view of the part of an electronic microscope in which the shutter is mounted, and

Fig. 3 is a view of the control knobs.

Referring to the drawings, 1 denotes the vacuum wall of the electronic microscope. 2 is a photographic plate, 3 a slit shutter and 4 a fluorescent screen on which the image produced by a microscope may be viewed before taking a picture thereof. To wind up the slit shutter 3 a knob 5 is employed whose axis passes through the vacuum wall 1 with the aid of a sealing cone 6. The rotation which is effected according to the direction as indicated by the arrow is transmitted to the shaft 9 of the slit shutter through the gears 7 and 8. To prevent the slit shutter from running down before a predetermined time elapses a pawl 10 is employed which cooperates with a ratchet wheel 11.

The release of the shutter is effected by means of the fluorescent screen 4 which may be rotated in the position shown in dotted lines by means of a sealing cone not shown in Fig. 2 which is operated exteriorly of the vacuum vessel. In the end position the fluorescent screen 4 presses against the lever 12 to which is secured the pawl 10. The pawl 10 is, consequently, pressed away from the ratchet wheel 11 so that the slit shutter 3 runs down. 13 denotes a holding spring of the lever 12 which presses before the release takes place the pawl 10 against the ratchet wheel 11 when winding up the slit shutter 3.

To adjust the exposure time also the knob 5 is employed. If the exposure time is to be adjusted the gear 7 is brought into engagement with the gear 14 which is secured to the shaft 9 of the slit shutter. The displacement of the gear 7 is effected with the aid of a knob 15 which drives a worm 17 having a great pitch. The worm wheel 18 cooperating with the worm 17

moves when actuated a forked lever 19 in the downward direction as indicated by the arrow so that the gear 7 slidably mounted on the shaft 20 moves also in the same direction till it meshes with the gear 14. In this position the exposure time may now be adjusted by rotating the knob 5. To facilitate the adjustment of the exposure time a pointer 21 and a scale 22 are allotted to the knob 5 as will be seen from Fig. 3.

As already mentioned above the release is effected with the aid of the fluorescent screen 4 within the sluicing device for the reception of the photographic material. Such a release prevents the production of faulty pictures which have hitherto been caused by the fact that the collapsible screen when releasing the shutter covers the plate as well as by the fact that the microscope is caused to vibrate when the screen comes into engagement with the vessel wall. These difficulties are avoided by the apparatus according to the invention, since in this case the fluorescent screen is operatively connected with the shutter.

Instead of a slit shutter also a central metal shutter may be employed which is set and released, for instance, by rotating the screen. Such a central metal shutter may be arranged in the electronic microscope, for instance, beneath the projection lens. Also in this case two cones are used to actuate the shutter, one of which serving to adjust the exposure time and the other to set and release the shutter. The apparatus according to the invention may be employed in electronic microscopes, mass spectrographs as well as in all other electronic apparatus in which simple devices are required to produce pictures.

HEINZ OTTO MÜLLER.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

H. O. MÜLLER
APPARATUS FOR TAKING PICTURES OF THE IMAGES PRODUCED BY THE ELECTRON OPTIC APPARATUS
Filed Jan. 28, 1941

Serial No.
376,310

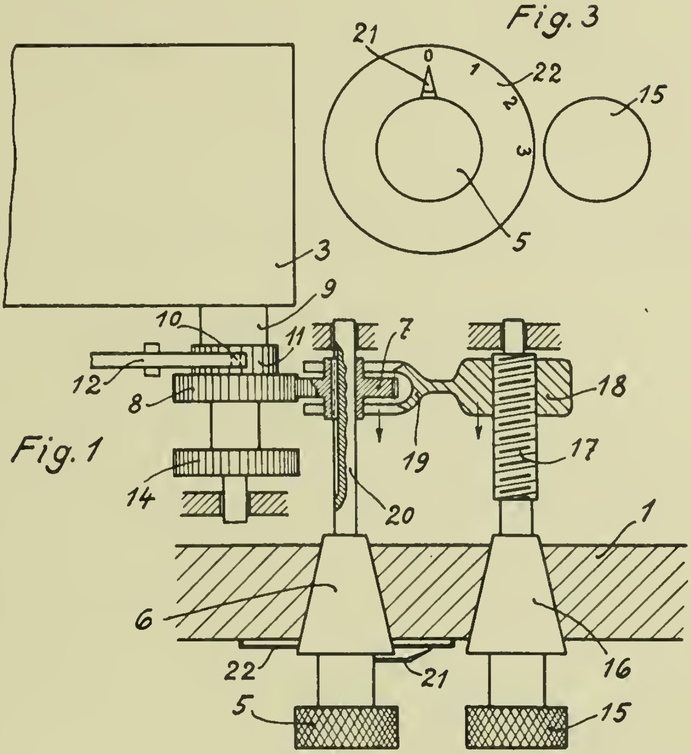
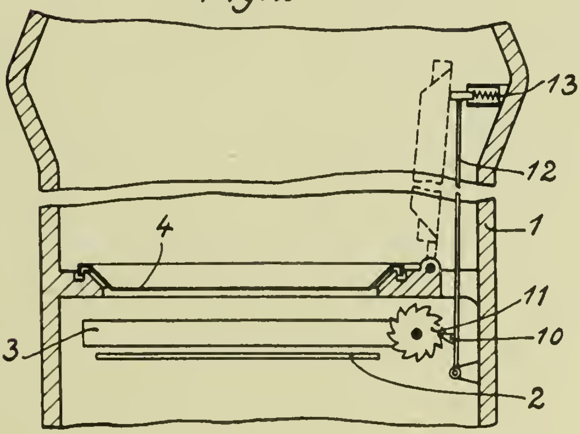


Fig. 2



Inventor:
Heinz Otto Müller

Published June 8, 1943 Serial No. 377,799½

ALIEN PROPERTY CUSTODIAN

RADIATOR

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Application filed February 7, 1941

This invention relates to a radiator built up from punched and drawn sheet-metal laminae.

The invention is illustrated by way of example in the accompanying drawing, in which

Figure 1 shows two laminae;

Fig. 2 shows a combination of laminae of the kind illustrated in Fig. 1;

Figs. 3 and 4 shows special kinds of lamellae connected by a peripheral flange;

Figs. 5 and 6 show, respectively, an oval and a prismatic lamella; and

Fig. 7 indicates a staggered arrangement of a number of lamellar units to form a heater.

The lamellae 1 shown in Figs. 1, 5 and 6 are each provided in their central portion with a drawn flange 2, and the diameter of the flanges is chosen so as to permit telescoping. There are always two lamellae 1 telescoped and united by rolling of their flanges 2, and each lamella 1 has at its circumference a bent edge 3, as shown in Figs. 1 and 2, one of the telescoped lamellae having a slightly smaller diameter and a narrower bent edge 3 than the other (Fig. 2).

Heaters of any length can be built up from such units comprising two lamellae united at their flanges 2 by rolling by inserting a unit of smaller diameter in a unit having a larger diameter and broader edge. In this way, hollow gills or ribs are built up from the lamellae 1 whose flanges 2 form a piping, as shown in Fig. 2.

A radiator of this type is chiefly intended for use in air heaters, etc. where it may be employed in vertical position. In order to adapt a heater according to the invention to operation in horizontal position and to prevent the accumulation of water therein, the flanges 2 are disposed at the periphery thereof, as shown in Figs. 3 and 4. Radiators of this type can be used in horizontal position without any fear of accumulating water.

Compared with the known radiators making use of a tube with attached ribs, the radiator according to the invention affords the advantage of a larger heating surface and shorter heat path combined with lower weight and, further, facilitates assembling in air heaters if the vertical type is employed. In this case, air resistance is lower also.

The heating units according to the invention permit, furthermore, a better staggered arrangement, as indicated in Fig. 7. This is of particular importance for vertical installation in air heaters, etc. so as to be able to accommodate more heating elements in a smaller space and to increase the heating effect.

EMIL WALTER STARKE.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

E. W. STARKE
RADIATOR
Filed Feb. 7, 1941

Serial No.
377,799½

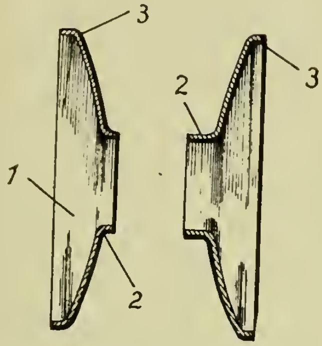

Fig. 1

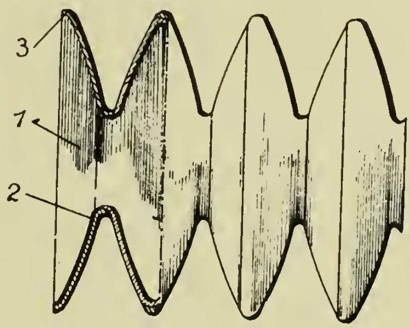

Fig. 2

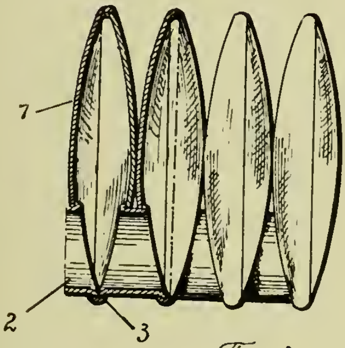

Fig. 3

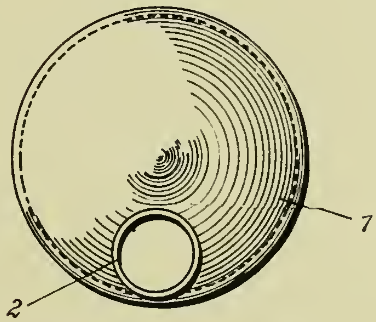

Fig 4

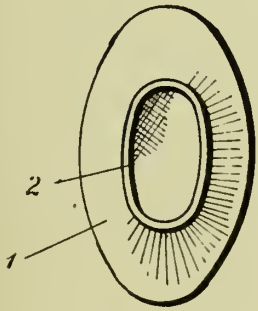

Fig 5

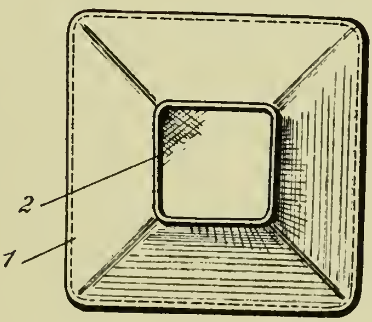

Fig. 6

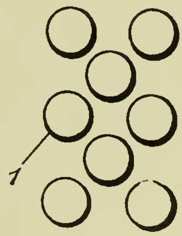

Fig. 7

Inventor:
Emil W. Starke

Published June 8, 1943

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ALIEN PROPERTY CUSTODIAN

CONDENSATION PRODUCTS AND A PROCESS OF PREPARING THEM

Hermann Wagner and Christoph Dörfelt, Frankfurt am Main-Hoechst, Germany; vested in the Alien Property Custodian

No Drawing. Application filed February 7, 1941

The present invention relates to condensation products and to a process of preparing them and it especially relates to sulfonic acid derivatives.

We have found that valuable condensation products may be obtained by reacting products containing sulfur, oxygen and chlorine, formed by the simultaneous action of chlorine and sulfur dioxide on saturated aliphatic hydrocarbons, with hydroxy-amines containing at least one reactive hydrogen atom at the nitrogen atom. The new condensation products have the general formula

$$R—SO_2—X$$

wherein $R—SO_2$ means the radical of a sulfochloride obtained by the simultaneous action of chlorine and sulfur dioxide on saturated aliphatic hydrocarbons and X stands for the radical of a hydroxy amine having at least one hydrogen atom bound to nitrogen.

By the simultaneous action of chlorine and sulfur dioxide on saturated aliphatic hydrocarbons, particularly with the simultaneous action of active rays of light and, if required, while applying catalysts, compounds are produced having the character of sulfonic acid halides.

As hydroxy amines containing at least one reactive hydrogen atom at the nitrogen atom, such products may be named as contain one or several hydroxy groups besides a primary or secondary amino group, or such products as contain several amino groups and one or several hydroxy groups in the molecule, e. g. ethanolamine, diethanolamine, the reaction products of glycide on primary amines, propanolamine-1.2, methylethanolamine, phenylethanolamine, cyclohexylethanolamine, naphthyl-ethanolamine, benzylethanolamine, dodecylethanolamine, furthermore aminodihydroxypropane, aminotrimethylolmethane prepared from nitromethane and 3 mols of formaldehyde and reduction of the nitro-trimethylolmethane produced; furthermore glucamine, methylglucamine, ethanol-glucamine, phenylglucamine or 1.3-methylaminopropanol.

According to the conditions applied in the reaction compounds constituted in an acid-amide-like and/or an ester-like manner may be obtained. The reaction may, for instance, be effected by stirring together the anhydrous starting materials; for binding the hydrogen chloride formed the hydroxyamine itself or another acid-binding agent may be used. If the hydroxyamine is applied in excess chiefly amide-like compounds are formed, whereas mainly basic, ester-like products are obtained if molecular proportions of the hydroxyamine and another acid-binding agent are used.

The ester-like products are readily saponifiable and, insofar as they contain free amino-groups they are readily transformed on heating into the ammonium salts of the corresponding sulfonic acids.

As acid-binding agents there may, for instance, be used tertiary bases, such as pyridine, triethylamine, dimethylaniline; furthermore alkali hydroxides or alkali carbonates; in that case, however, a partial saponification of the sulfochloride sets in, owing to the formation of water. The reaction is best performed in the cold or at a slightly raised temperature; it may also be carried out in an indifferent solvent, such as benzine, benzene, carbon-tetrachloride, dioxane, or the like.

The products obtained according to the process herein described are more or less viscous oils or solid, sometimes crystalline bodies. They are suitable for instance as softening agents for plastic masses and for finishing textile materials, furthermore as intermediate products for the manufacture of adjuvants for the textile industry.

The following examples serve to illustrate the invention, but they are not intended to limit it thereto, the parts being by weight:

(1) A solution of 71 parts of propane sulfochloride (obtained by the action of sulfur dioxide and chlorine on a solution of propane in carbon-tetrachloride with the simultaneous action of short-wave light) in 80 parts of dioxane is added at a temperature of 5° C–10° C in the course of about two hours; while well stirring, to 91 parts of anhydrous monoethanolamine. After stirring has been continued for two hours at 20° C the mixture is neutralized with alcoholic hydrochloric acid. From the consumption of hydrochloric acid there is calculated that 1.95 to 1.99 mols of base have been consumed per 1 mol of sulfochloride, i. e. that sulfonic acid ethanolamide is obtained in a yield of 95 to 99 per cent of the theoretical yield. After the distillation of the solvent, suitably under a reduced pressure, the product is mixed with 150 parts of acetonitrile, the ethanolamine-hydrochloride is filtered with suction and subsequently washed with a small quantity of acetonitrile. After the solvent has been distilled under reduced pressure, the propane-sulfonic acid ethanol amide is obtained from the filtrate in the form of a light brown, viscous oil which very readily dissolves in water, alcohols and esters and sparingly dissolves in hydrocarbons, chlorinated hydrocarbons and ether.

If only 61 parts of ethanolamine are used instead of 91 parts and if otherwise the process is effected as described above; about 18 per cent of an esterlike condensation product are obtained besides about 82 per cent of an amide-like condensation product.

(2) 71 parts of propane sulfochloride are added in the course of two hours, at a temperature between 5° C and 10° C, while well stirring, to an

anhydrous mixture of 31 parts of ethanolamine and 48 parts of dimethylaniline. After about two hours the content of non-consumed base is ascertained by titration in a test portion. Per 1 mol of sulfochloride a consumption of 1 mol of base is found, i. e. sulfonic acid ester has been substantially completely been formed. After a dilution with benzene and a filtration with suction the hydrochloride of the ethanolaminopropanol-sulfonic acid ester is obtained in the form of hygroscopic crystals.

(3) 71 parts of propane-sulfochloride are caused to run in the course of two hours, while well stirring and cooling with ice, into 112 parts of anhydrous methylethanolamine. The yield of propane-sulfonic acid methylethanol amide, calculated as described in example 1, amounts to 94 per cent of the theoretical yield. The propane-sulfanic acid methylethanolamide mixed with the hydrochloride of the methylethanolamine is obtained in the form of a honey-like oil which is very readily soluble in water, alcohol and acetonitrile and is substantially insoluble in hydrocarbons, chlorinated hydrocarbons, ether and dioxane.

If 160 parts of diethanolamine are used instead of 112 parts of methylethanolamine, the propane-sulfonic acid diethanolamide is obtained in a yield of 90 per cent of the theoretical yield.

(4) 100 parts of a product containing 11.76 per cent of a hydrolysable chlorine are caused to run in the course of 2–3 hours, at a temperature between 5° C and 10° C, while well stirring, into 80 parts of anhydrous ethanolamine. The product named was obtained by the action of sulfur dioxide and chlorine, with the simultaneous action of short-wave light, on a mixture of hydrocarbons boiling between 240° C and 340° C formed by hydrogenation of carbon monoxide without application of pressure, and separation of the unaltered portion of hydrocarbons by means of sulfur dioxide. After the whole has been stirred for about 3 hours at room temperature, the consumption of base is ascertained as described in example 1. It is proved that sulfonic acid ethanolamide has substantially completely been formed.

The mixture of reaction may be worked up as follows: By the introduction of gaseous hydrochloric acid the ethanolamine is completely transformed into the hydrochloride and, suitably after the addition of benzene, it may substantially completely be separated by filtration and may be washed with benzene. The benzene is removed from the filtrate by distillation. Otherwise there may also be added to the mixture a quantity of concentrated alkali lye equivalent to that of hydrolyzable chlorine and the ethanolamine together with small portions of hydrocarbons may be driven off suitably under reduced pressure. The alkali chloride may be readily separated by filtration. By both methods the sulfonic acid ethanol amide is obtained in the form of a viscous, light-brown oil which is soluble in about 2N-caustic soda solution and most organic solvents to form a clear solution. It is readily emulsifiable in water.

(5) 324 parts of a product containing chlorine, oxygen and sulfur in an approximately molecular proportion of 1:2:1, obtained by the action of chlorine and sulfur dioxide on hexadecane, while simultaneous subjecting the reaction mixture to the action of ultraviolet rays, the dissolved in 400 parts of benzene and the solution is caused to run at room temperature, while stirring, into 135 parts of ethanol amine. The mixture is then heated for 2 hours to 60° C–70° C. After cooling the solution is washed with a solution of sodium sulfate of 5 per cent strength. The benzene solution is dried with sodium sulfate, filtered and the benzene is removed by distillation. There are obtained 250 parts of a clear, feebly yellow oil. The product chiefly consists of sulfamide-like condensation products and is soluble in 2N-caustic soda solution.

(6) 310 parts of a product containing chlorine, oxygen and sulfur in an approximately molecular proportion of 1:2:1, obtained by the action of chlorine and sulfur dioxide on a saturated hydrocarbon fraction boiling between 240° C and 340° C and obtained by the reduction of carbon monoxide without application of pressure, are mixed at about 20° C—30° C, while cooling, with 320 parts of diethanolamine. The mixture is further stirred for 2 hours at 20° C—30° C. The product is freed by washing it with a sodium sulfate solution of 20 per cent strength from the diethanolamine hydrochloride which has precipitated. After drying a feebly brownish, viscous oil is obtained which chiefly consists of sulfonamides.

(7) 349 parts of a product containing chlorine, oxygen and sulfur and obtained by the action of chlorine and sulfur dioxide on paraffine having a molecular weight of 251, are dissolved in 500 parts of carbon tetrachloride. The solution is caused to run into 140 parts of phenyl-ethanolamine saturated with ammonia, the ammonia being passed through the mixture. When the reaction is complete the mixture is separated by filtration from the ammonium chloride which has precipitated and the solvent is removed by distillation. There is obtained a brown, viscous mass which chiefly consists of the basic sulfonic acid ester.

(8) 27 parts of N-dodecansulfochloride obtained by the action of sulfur dioxide and chloride on n-dodecane while simultaneously subjecting the product to the action of ultraviolet rays, are slowly introduced, at room temperature, into a solution of 23 parts of methyl-glucamine in 1000 parts by volume of pyridine. The whole is subsequently stirred for about 1 hour at 40° C.–45° C. When a test portion dissolves in water to a clear solution, the pyridine is distilled, suitably under reduced pressure. The residue is taken up with a small quantity of hot water, mixed with 6 parts of calcined sodium carbonate and evaporated. The residual pyridine escapes during said operation and the condensation product is obtained in the form of a viscous solid mass, still containing sodium chloride. The condensation product may be purified by extraction from the crude product with an organic solvent, such as benzene, acetone or methylene chloride. The condensation product dissolves in water to form clear, strongly foaming solutions. The crude product consists of a mixture of sulfonic acid esters and sulfonic acid amides and may also contain methylglucamine-dodecane-sulfonate.

If, instead of 27 parts of n-dodecane-sulfochloride, 35 parts of octadecane-sulfochloride are used, obtained from n-octadekane by means of chlorine and sulfur dioxide, and if the process is otherwise carried through as described above, a condensation product of quite similar properties is obtained.

HERMANN WAGNER.
CHRISTOPH DÖRFELT.

Published June 8, 1943

Serial No. 377,847

ALIEN PROPERTY CUSTODIAN

CLOSED CAPACITIES

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No Drawing. Application filed February 7, 1941

Up to the present time, practically all objects constituting closed chambers in which a vacuum is to be maintained, have been made of glass, because this substance has the property of keeping a practically perfect vacuum. However, glass has the very serious drawback of being brittle.

On the other hand, difficulties have been experienced when it has been endeavoured to make such objects of metals, because if metals are much more resistant than glass, they maintain vacuum in an imperfect manner.

The object of the present invention is to provide articles containing vacuum chambers which are made of a substance capable of preserving vacuum while having a good mechanical resistance.

Now, I have found that, contrary to what might have been expected, some organic materials are capable of preserving vacuum substantially to the same degree as glass. These organic materials belong to the group of synthetic resins, and the best results have been obtained with the polystyrols which have very special advantages from this point of view.

On the other hand, these materials have mechanical properties which are much better than those of glass.

An essential feature of the present invention therefore consists in making objects forming chambers in which a vacuum is to be established and maintained, of synthetic resins and in particular polystyrols, these substances being used either in the pure state or mixed with other substances.

In particular, the synthetic resins in question are advantageously mixed with silica, so as to obtain a mixture which is better adapted to resist heat and shocks. Objects of the kind above referred to, made of the substances or mixture of substances in question, will have many advantages. The chief of these advantages are the possibility of obtaining both a high resistance to shocks (which can never be obtained with glass), an easy moulding, welding, coloring, transparence, while the possibility of maintaining a high vacuum is substantially the same as in the case of glass.

Among the possible applications of synthetic resins and in particular polystyrols to objects according to the present invention, I will indicate the following:

The manufacture of bottles and containers of the so-called isotherm type, which can be made either transparent or opaque, the manufacture of electric bulbs for lighting or radio, the construction of manometric boxes with parallel corrugation; and in a general manner the fabrication of all objects forming closed chambers in which a more or less considerable vacuum is to be maintained for a long time.

It is also possible, according to the invention, to produce structures constituted by the assembly of plates or other elements made of these organic materials and forming closed chambers, or to make use of elements of these materials made of a single piece and provided with such recesses.

Such constructions will permit of protecting airplane cabins, the inside of automobile vehicles, walls, floors, ceilings of rooms against the action of cold or heat of the surrounding medium.

ROBERT HIRSCH.

Published June 8, 1943 Serial No. 379,542

ALIEN PROPERTY CUSTODIAN

METHOD AND DEVICE FOR TIEING THREAD ENDS IN WINDING FRAMES OR OTHER TEXTILE MACHINES

Stefan Fürst, Munchen-Gladbach, Germany; vested in the Alien Property Custodian

Application filed February 18, 1941

In order to tie the one with the other the thrums of the running on and running off thread by a weaver's knot, a loop with crossed arms has hitherto been formed from one of the thrums to be tied. This loop is then laid around a support shiftable in its axial plane and an auxiliary loop is formed by means of a thread guide through which auxiliary loop the other thread thrum is pulled. The thread guide then moves out of the first auxiliary loop with formation of another auxiliary loop without crossing of the thread arms, whereupon the auxiliary loop is undone and the knot pulled together after the tieing has been liberated by the supporting element. This tieing proceeding is very complicated and accordingly also the arrangement for carrying it out mechanically.

According to the invention the tieing proceeding is considerably simplified, so that the binding nose-ends generally used successfully in hand-operated implements can be used for carrying out this tieing proceeding.

The tieing proceeding takes place, according to the invention, in that the thread thrums, the ends of which point in opposite directions are laid non-crossed into the bent of a binding nose-ends, their mutual position being such, that the binding nose-ends when carrying out a three-quarter rotation grip behind the thread parts lying on one side and oscillates between the thread parts lying on the other side, so that two thread-loops are formed, whereupon at a further semi-rotation of the binding nose-ends these binding nose-ends open and grip the end of the one thrum and finally cut off this end at a further quarter-rotation and clamps the same in, whereas the other thread-thrum is cut off by scissors and finally the thread tieing is pulled off the binding nose-ends.

The pulling off end itself is preferably temporarily clamped according to the invention at the drawing off of the thread tieings from the binding nose-ends and the pull is exerted by means of a separate element moved towards the thread.

The former employment of the binding nose-ends or the construction of the coordinated thread slits and clamps depended at the formation of the weaver's knot on the supposition, that the ends of the torn thread thrums had to be laid in pointing in the same direction, in order to produce the knotting. If namely it had been tried in the usual manner of operation with ends of the thread thrums pointing to different sides to form a weaver's knot, a tieing in the sense of a weaver's knot would occur, but the ends to be pulled are then lying so that the knot formed at the tieing is not self-checking but unties again when a pull is exerted upon the knotted thread.

An embodiment of the invention is illustrated by way of example in the accompanying drawing, in which

Figs. 1 to 5 illustrate the main phases of the tieing proceeding,

Figs. 6 and 7 show the knotter in a central section on line VI—VI of Fig. 9, viewed from the side, its elements being in different positions,

Fig. 8 shows a part top plan viewed, in the direction of the arrow VIII in Fig. 6,

Fig. 9 the guiding of the bolt 22 in front view, partly in section.

Fig. 10 a detail of the knotting proceeding.

In the side walls 1, 2 of the shape common in knotters the several notched bars and the means for moving the same are mounted. The knotter is connected in the form of construction shown in Fig. 6 with its carriage by an arm 3. The binding nose-ends B consist in usual manner of a main part comprising a worm 4 and of clamping parts 5 and scissors parts 6 being in front of said main part. All movements are released by a feed lever 7 oscillatable about a bolt 23 and correspondingly bent at an angle as shown in Fig. 9 and connected with any control element of the frame. At an oscillation of lever 7 in anti-clockwise direction from the position shown in Fig. 6 into the position shown in Fig. 7 the worm 4 of the binding nose-ends is turned, the lever 7 striking, shortly before its extreme position, against the nose of an ejector 8, by which ejector the tied threads are pulled off the binding nose-ends in known manner, as shown in Fig. 7. A bolt 9 is further fixed on lever 7 and acts on a lever 11 pivotably mounted on pin 10, the front end of said lever having a small notch 12 for holding the thread c. The lever 11 further carries a bolt 13, which moves in the slit of a notched bar 14. The notched bar 14 and the notched bar 15 form scissors as shown in Fig. 8. A clamping plate 16 is further coordinated to the notched bar 14 and controlled by a spring 17, the starting position of the clamping plate being limited by a bolt 18, as shown in Fig. 6.

In front of the lever 7 a pawl 19 is mounted oscillatable about the same pin 23 under the action of a spring 24. If the lever 7 arrives in the position shown in Fig. 7 the pawl 19 catches a bolt 20 fixed on the ejector 8. The ejector 8 shown in Fig. 7 is for clearness sake partly broken off in Fig. 6.

The knotting proceeding illustrated in Figs. 1

to 5 takes place in that the thread thrums *a, b* are laid behind the bent end of the binding nose-ends B, so that their ends *c, d* point in opposite directions. If then the binding nose-ends B turn, they grip behind the thread part *b, c* as shown in Fig. 2 and continuing its turning movement they get, in forming two loops, between the thread parts *a, d* as shown in Fig. 3. After the binding nose-ends have carried out a complete rotation, they open and grip at the next following quarter-rotation as shown in Fig. 4 the thread end *c* and cut off the same at a further quarter-rotation, as shown in Fig. 5. At the same time scissors S, the elements **14**, **15** are shown in Figure 8, have come into effect and cut off the thread ends *d*. The end *c* of the thread which is not cut off is securely held by the binding nose-ends B, whereas then the ejector **8**, as shown in Figs. 7, 8, 10, pulls off the loops from the binding nose-ends. The part of the thread end *c*, which has not been cut off, is then securely held by the clamp **5** of the binding nose-ends as shown in Fig. 10, whilst in turn the thread is securely held by the clamping arrangement **14**, **16**, so that the knot is tied orderly under the action of the ejector **8** moving downward as shown in Fig. 7 and 10. In the position shown in Fig. 7 the knotted threads are held until the notched bars have returned approximately into their starting position, as otherwise the backward moving binding nose-ends would grip the already knotted thread ends and tear the same, as the threads either are caught in the scissors or would intertwine with the same. Shortly before the starting position is reached, as shown in Fig. 6, the lever **7** lifts the pawl lever **19** from bolt **20**, so that now the ejector **8** can also return into its starting position under the action of a spring **21** on bolt **22** as shown in Fig. 9, in liberating the threads.

Although the form of construction of the knotter as shown is intended in the first instance for winding frames, the invention is not limited hereto, but may be applied anywhere in textile machines, when thread thrums have to be knotted mechanically as for instance also in warping machines.

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BY A. P. C.

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METHOD AND DEVICE FOR TIEING THREAD ENDS IN WINDING FRAMES OR OTHER TEXTILE MACHINES

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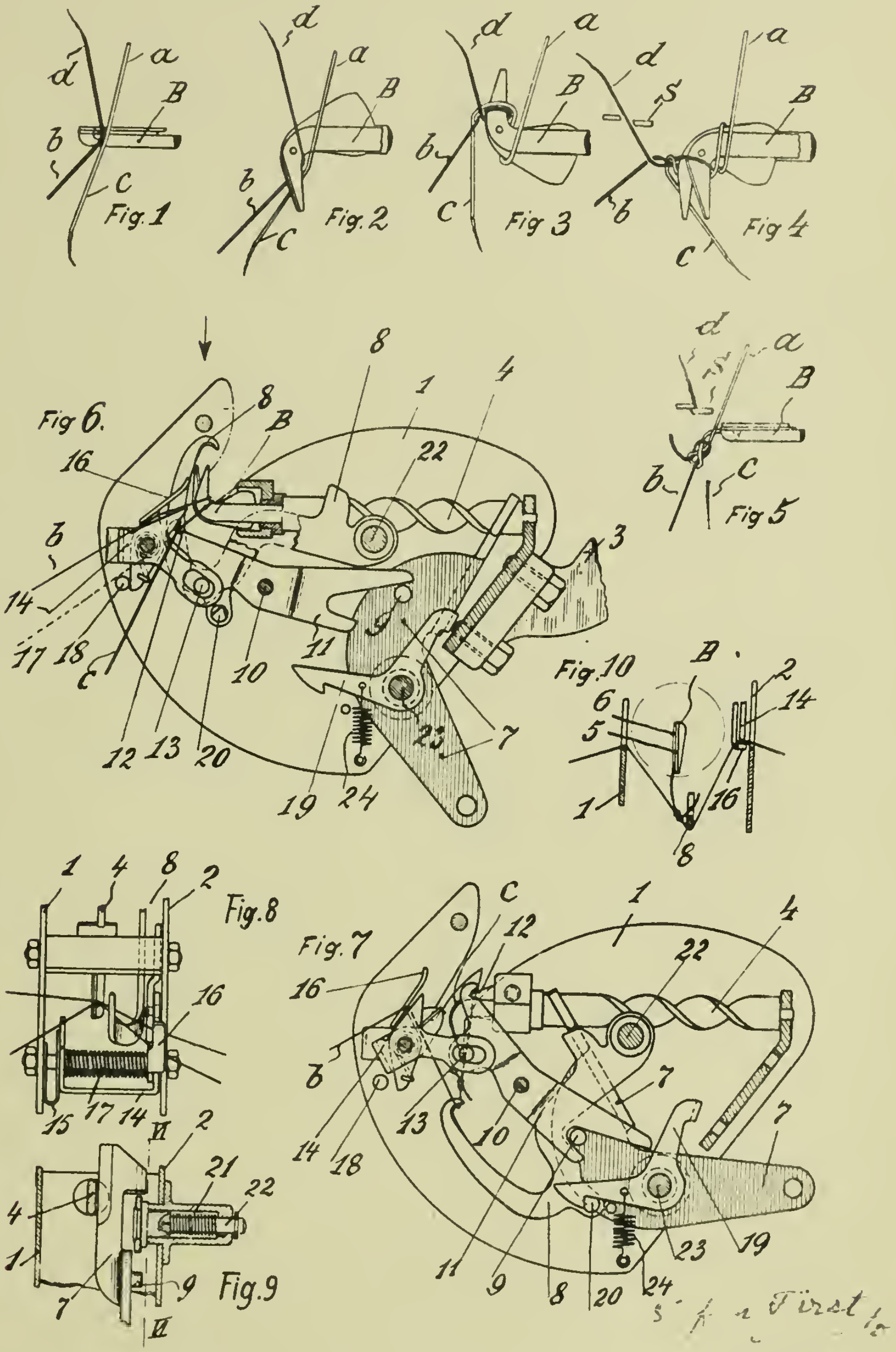

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR SUPER - POSITION OF TWO ULTRA - HIGH - FREQUENCY ELECTRO-MAGNETICAL-OSCILLATIONS

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Application filed February 24, 1941

In regard to super-heterodyne receivers the oscillator as well as the aerial is to be coupled to the miscellaneous tube in such a way that the oscillator-tube will not radiate over the aerial. By miscellaneous tube it is understood a tube in which the super-position and rectifying of two oscillations takes place.

The invention refers to a device for super-position of two ultra-high frequency electro-magnetical systems of oscillations respectively for discoupling of two such systems of oscillations, especially for the purpose of super-heterodyne receiving methods. In such case there can be used a Lecher-system to which the second oscillation is The one conductor of this Lecher-system branches in two conductors which form a second Lecher-system to which the second oscillation is led. The arrangement of these two Lecher-systems is made in such manner that the two conductors of the branching system oscillate in push-pull and both together work in respect to the other conductor of the first Lecher-system in the same rhythm.

For a fuller description of my invention reference is made to the accompanying drawings.

Figure 1 shows a scheme of circuit which embodies the general scope of the invention.

Figure 2 shows an arrangement which corresponds to the general scheme and which at the same time shows the transmission of the general scope of the invention to the special case of ultra-short waves. In these case the Lecher-system are shown as concentric pipe-conductors.

According to Figure 3 the coupling of the two Lecher-systems is made by a current-loop, i. e. a wire bent like a hair-pin with which the one system projects into the magnetical field of the other Lecher-system.

Figure 4 shows the coupling being made by means of a slit in the outer conductor of the one Lecher-system.

Fig. 3*a* and 4*a* show cross sectional views of the arrangement of the Lecher-system as shown in Figs. 3 and 4.

In Fig. 1 there is shown schematically a bridge-device. A two wire system 5, 5′, coming from the aerial leads to a resonance circuit 6 consisting of capacity and inductance in parallel connection. From the resonance circuit 6 the conductors lead to two blocking condensers 7 and 7′ and from there to the miscellaneous tube f. i. to the anodes 8 and 8′ of a duo-diode. To the centre of the inductance of the resonance circuit 6 on one hand and to the cathode 9 of the duo-diode on the other hand there are connected the two conductors of a Lecher-system coming from the oscillator-tube. Furthermore the primary windings 11, 11′ of a push-pull transformer for the intermediate frequency are connected to the anodes 8 and 8′. The two windings 11 and 11′ are counterturned. For preventing the high frequency flowing to the intermediate frequency transformer the two resonance circuits 12 and 12′ are inserted in the connection wires between the anodes 8 and 8′ and the windings 11 and 11′. The thick lines in Fig. 1 show conductors which lead high frequency whilst the thin lines show conductors which only lead intermediate frequency.

The circuit shown in Fig. 1 acts as follows:

The energy line 10 and 10′ is leading a high frequency oscillation from the oscillator to the bridge device. Both anodes 8 and 8′ of the duo-diode oscillate in like rhythm in regard to the cathode 9. The high frequency current of the oscillator-tube flows through both halves of the inductance of the resonance circuit 6, through the blocking condensers 7, 7′, through the anodes 8 and 8′, through the cathode 9 of the duo-diode and from there back to the oscillator. (The inductance of the parallel resonance circuit 6 can be compensated by a capacity in the leading conductors). This flowing causes a directed current from the cathode 9 of the duo-diode to the centre of the primary windings 11, 11′ of the intermediate frequency transformer. This directed current will not produce any potential difference at the secondary windings of the intermediate transformer, for both the halves of the windings 11 and 11′ are wound in counter-turnings. This causes no effecting from the windings 11, 11′ to the secondary windings for equal currents are flowing from the centre to the ends of the primary windings 11 and 11′. If in the contrary there exists a high frequency voltage in the energy line 5, 5′ coming from the aerial the anodes 8 and 8′ of the duo-diode oscillate in push-pull. The currents which are flowing in the primary windings 11 and 11′ of the transformer have the same direction. Currents of this kind will not compensate each other in regard to the secondary windings but produce a directing voltage at the terminals of the secondary windings. The high frequency current coming from the aerial is flowing f. i. through wire 5 and blocking condenser 7 to anode 8 of the duo-diode and from there to cathode 9 and anode 8′, and from there to blocking condenser 7′ through the wire 5′ back to the aerial.

In Figure 2 an arrangement corresponding to

the scheme of Fig. 1 is shown suitable for using ultra-short waves especially waves of a wave length less than 1 m. The first Lecher-system comprising the conductors 1 and 2 is coming from the oscillator-tube. The conductor 1 branches into two conductors 3 and 4 at the point 13. These new conductors form a second Lecher-system consisting from two wires of a length of $\lambda/2$ or a multiple thereof. (λ=wave length). The system 3 and 4 is short circuited by a plate 14 serving as a bridge. The conductors 3 and 4 are forming a resonator between 13 and 14 which if excited oscillators in push-pull. On the other hand if one connects the conductor 2 to the plate 14 in this manner that there is a potential node at this point also for the Lecher-system 1, 2 there can be led a high frequency oscillation over the system 1, 2 which causes a rhythmical oscillation of the conductors 3 and 4 together in respect of the conductor 2. The push-pull oscillations can be excited f. i. by an opening 15 in the reflecting plate 14 with the aid of current coupling. The miscellaneous tube, f. i. the duo-diode is then connected near to a potential loop between the conductors 3 and 4, i. e. in a distance of $\lambda/4$ from the plate 14 in such manner that the anodes 8 and 8′ over-blocking capacities 7, 7′ are connected with conductors 3 respectively 4 whilst the cathode 9 is directly connected with conductor 2. The miscellaneous tube presenting at the same time an impedance it will be necessary to make the length of the conductors 3 and 4 not exactly $\lambda/2$ but equivalent to $\lambda/2$ in such manner that the Lecher-system is tuned to the wanted wave length in spite of the valve impedance.

In Figure 3 the arrangement according to Fig. 2 is repeated in case the Lecher-system is formed concentrically. The two conductors 3 and 4 are connected to the branching point 13 in form of a wire bridle in the same manner as in Figure 2. For better understanding in Fig. 3 this arrangement is shown cross sectionally along the line A—A. The wires 3 and 4 are short circuited with the outer conductor 2 at 16 through capacity 17, so that the rhythmical oscillation led from 1, 2 has a potential node at 16. Between the conductors 3 and 4 the outer conductor 14 serving as reflecting plate (of a further) concentric Lecher-system 14, 18 has an opening through which the conductors 3 and 4 project in form of a current loop 19 into the magnetical field of the Lecher-system 14, 18. For getting a perfect symmetric coupling to the system 14, 18 in regard to the conductors 3 and 4 it is advantageous to provide the loop 19 in a potential node of the Lecher-system 14, 18. The centre of the loop 19 has thus a distance of $\lambda/2$ or a multiple thereof of the short-circuited end 20 of the system 14, 18. From this follows that by such arrangement the aerial oscillation introduced at 21 causes no rhythmical oscillation at 22 and vice versa the oscillation of the oscillator-tube introduced at 22 causes no push-pull oscillation at 21. This is a consequence of the symmetry of the arrangement. If in the practical device symmetry is not preserved perfectly it can be restored with the aid of small trimming capacities connected between the conductors 3 and 4 on the one hand and the outer conductor 2 on the other hand.

Near to a potential loop of the system 3, 4 the anodes of the duo-diode 23 are coupled to the conductors 3 and 4 through the blocking condensers 7 and 7′ whilst the cathode is connected to the jacket 2. The directed current can be drawn from the wires 24 which are to be led free of inductance and parallel to the conductors 3 and 4. They can run in the inner of the pipe-like conductor 1 to the intermediate transformer.

Figure 4 shows another embodiment of the invention. Instead of a current loop 19 projecting into the magnetical field of the Lecher-system 14, 18 as shown in Figure 3 there is provided a slit 25 in the outer conductor 14 symmetrically to the conductors 3 and 4 effecting a coupling between the Lecher-systems 14, 18 and 3, 4. Besides the blocking condensers 26 and 26′ are formed as concentric pipes provided insulated round the conductors 3 and 4 and to themselves the diode 23 is connected. The pipes 26 and 26′ form the second Lecher-system for they lead the push-pull oscillation as well as the conductors 3 and 4. The arrangement is shown in Figure 4*a* in a sectional view along the line B—B. The wires for the directed current are connected in a potential node to the blocking condensers 26 and 26′ and are furthermore led insulated in the inner of the conductor 1 to the intermediate frequency transformer.

It is advantageous as shown in all figures to provide the aerial-oscillation as push-pull oscillation and the oscillator-tube oscillation as rhythmical oscillation for the push-pull oscillation needs no high frequency energy in the cathode conductors. These cathode conductors are advantageously made from thin wires for preventing heat losses. For this reason they would be a rather strong damping for the weak aerial-oscillations. On the other hand the oscillator-tube possesses a large energy and therefor the damping will not trouble it.

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2 Sheets-Sheet 1

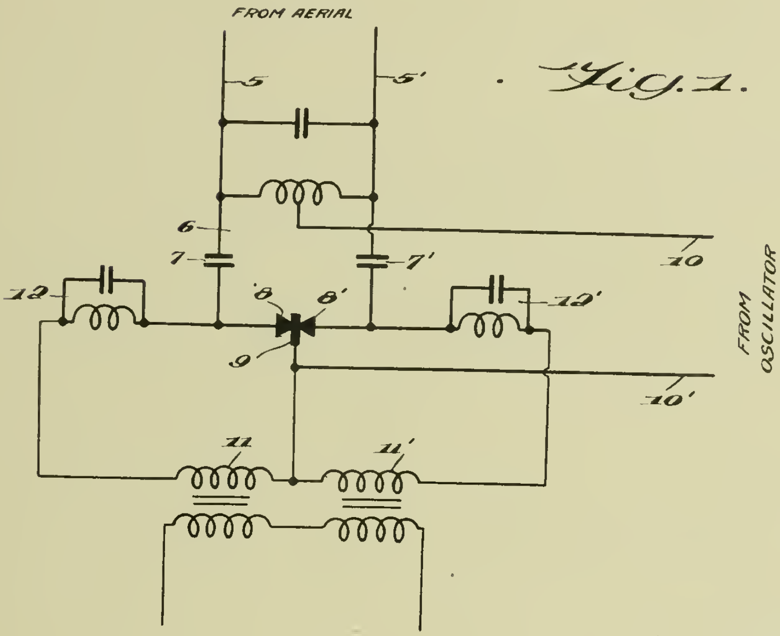
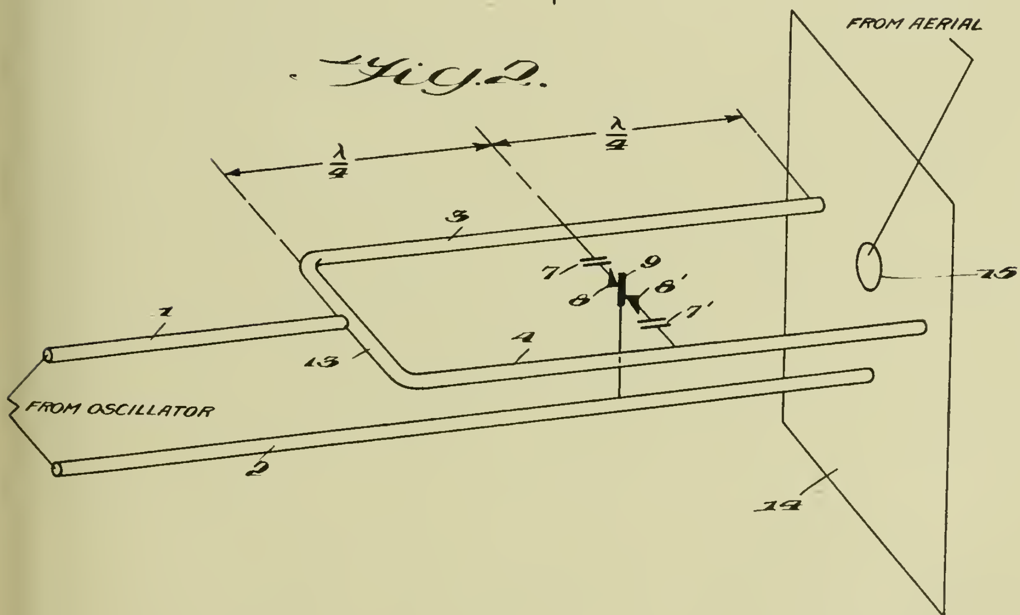


Fig. 1.

Fig. 2.



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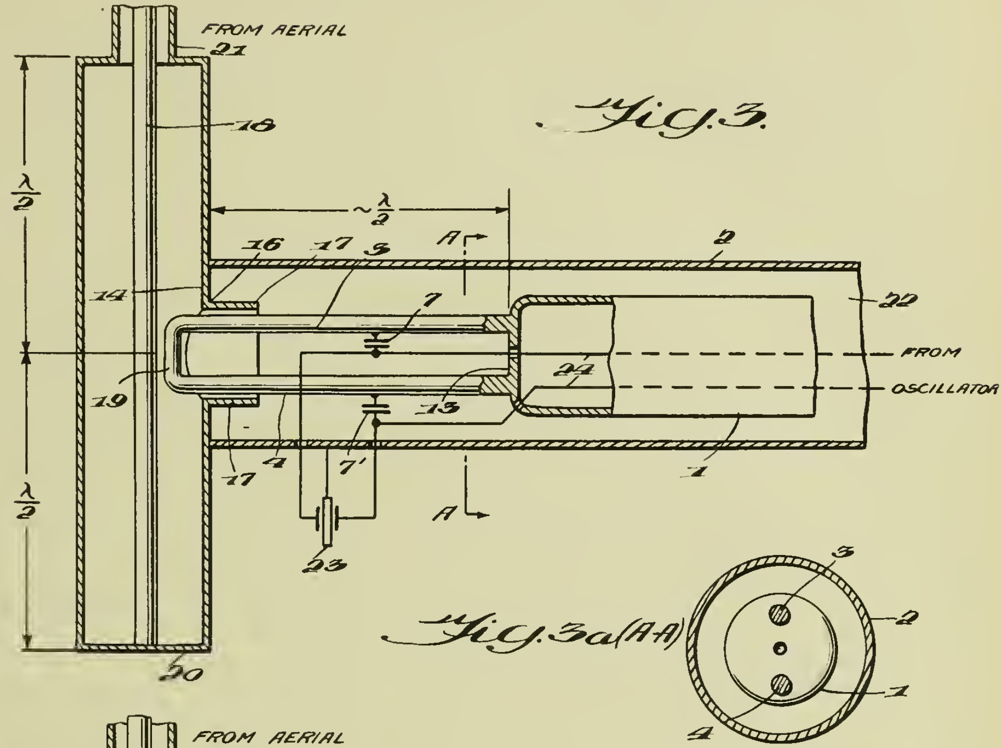

Fig. 3.

Fig. 3a (A-A)

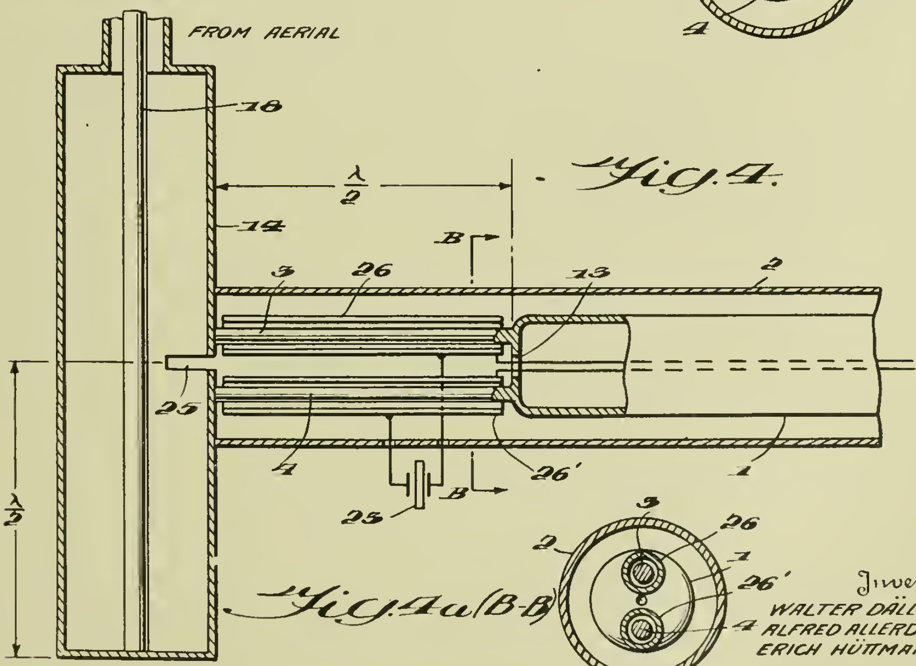

Fig. 4.

Fig. 4a (B-B)

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ALIEN PROPERTY CUSTODIAN

PARACHUTES

Georges Dreyfus, Montauban, France; vested in the Alien Property Custodian

Application filed February 28, 1941

The present invention relates to parachutes.

The object of the invention is to provide an apparatus of this type, which is better adapted to meet the requirements of practice, than the parachutes made up to the present time, and especially to increase the comfort of the parachutist when he is coming down and, therefore, his safety.

The essential features of the invention consist in the provision of means for exerting on the parachutist, while the parachute is not still open, a stabilizing action which keeps said parachutist in a given position.

Another feature of the invention concerns the parachutes including a bag with two compartments, containing respectively the parachute proper and the ropes through which the parachutist is suspended to said parachute. This feature consists in establishing, between these compartments, a communication through at least one orifice, for the passage of said ropes, said orifice being adapted to exert on said ropes a breaking action when the parachute is opening.

Other features of the present invention will result from the following detailed description of specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example and in which:

Fig. 1 is a front view of a parachutist's equipment, made according to an embodiment of the invention.

Fig. 2 is a rear view of the same equipment.

Fig. 3 is a view analogous to Fig. 2, showing the stabilizing parachute after it has been given out from its bag.

Fig. 4 is a diagrammatic plan view of a parachute bag (supposed to be opened) to be used in connection with the device of Figs. 1 to 3.

Fig. 5 is a sectional view of the same bag made according to the invention.

Fig. 6 is a view analogous to Fig. 2, showing the parts of the opening of the main parachute.

The invention is applicable to parachutes of all kinds, adapted to be worn on the back or the chest, or otherwise.

The whole of the parachute system is made of any suitable construction, the parachute proper and the suspension ropes being contained in a bag (for instance including four flaps designated by reference numerals **1**, **2**, **3** and **4**), said bag being itself supported by an equipment or harness, the different elements of which are designated by reference numerals **5**, **6** and **7**.

According to the invention, I further provide means for exerting on the parachutist, before the opening of the parachute proper, a stabilizing action which tends to keep him in a given position.

As a matter of fact, it becomes more and more usual to let the parachutist drop freely for a certain time after he has left the airplane, the parachute being opened only when the parachutist is nearing the ground. Now, in the course of its free drop, the body of the parachutist is wholly unstable and this may produce giddiness, so that the parachutist is unable to operate the parachute opening device when this recomes necessary.

The object of the invention is to obviate this serious drawback.

The stabilizing means above mentioned may be of many different kinds.

For instance, according to an advantageous arrangement, I make use of a small auxiliary parachute, adapted to open as soon as the parachutist leaves the airplane, either automatically, or through a manual action, this small parachute exerting for instance an action on the belt or the shoulders of the parachutist, so as to keep him in a vertical position or in any other position, provided that it is stable.

For instance, according to the embodiment illustrated by the drawings, I combine with the main bag **1**, **2**, **3**, **4**, a small bag or auxiliary pocket **8**, advantageously carried by one of the flaps **1**, this pocket being adapted to contain the auxiliary parachute, the surface of which has an area of one or two square meters, or even more.

Concerning bands, the means for producing the opening of the auxiliary parachute, and supposing for instance that they are of the manual control type, they are advantageously constituted by a system including a cable adapted to slide in a flexible shift **9** and operable through a hand grip **10**. This system causes for instance spindles or pins **11** to move out from the corresponding logs **12**, said pins and logs constituting the closing means for the pocket **8**.

The above described means thus enable the parachutist to open the stabilizing parachute (which is mounted in this pocket in a known manner), as he leaves the airplane.

When the parachutist wishes to open the main parachute, he has merely to act on the usual control, which, in the drawings, is supposed to be constituted by a second hand grip **13**, a cable

in a flexible shift 14 and spindles 15 coacting with logs 16.

Preferably, I further provide means for detaching the stabilizing or auxiliary parachute from the system, chiefly in order to avoid the risk of said auxiliary parachute becoming entangled with the main parachute. These last mentioned means are for instance combined with the means, designated by reference numbers 13, 14, 15 and 16, for controlling the opening of the main parachute.

On the drawings, I have shown an embodiment in which the suspension ropes of the auxiliary parachute (which are not visible on the drawings) are all secured to straps 17, which are themselves connected to other straps 18 belonging to the parachute harness. The connection between straps 17 and 18 is adapted to permit their immediate separation when so desired. For instance, straps 17 are assembled with straps 18 through spindles 19 engaged in holes provided in projections 20, carried by straps 17 and engaging in corresponding apertures provided in straps 18.

This arrangement is visible in Figure 3 of the drawings. In order to release and detach the auxiliary parachute, it suffices to operate the released device above described through wires 21, connected with wire 14, so that the fact of pulling handle 13 permits of simultaneously or successively detaching the stabilizing or auxiliary parachute and opening the main parachute.

According to another feature of the invention, it may be advantageous to make use of the first parachute for producing the extraction of the second from its bag or at least for facilitating this extraction. For this purpose, I provide for instance a wire 22 for connecting the stabilizing parachute with the centre of the main parachute.

In Fig. 6, I have diagrammatically shown the bag in its open position. This corresponds to the main parachute (not visible on the drawings) being unfolded, its supporting ropes 23 being divised into two groups, respectively connected to elements 23 of the harness. In this figure, the stabilizing or auxiliary parachute (only portions 17 of which are visible) being shown as detached from the main parachute system.

Of course, the operations relating first to the unfolding of the stabilizing parachute, then to the detaching thereof and finally to the unfolding of the main parachute, might be obtained through a single control system, for instance a single handle, the movements of which would be divided into several successive steps.

Finally, in Figs. 3 and 5, I have shown a bag made according to another feature of the invention.

According to this arrangement, this bag is divided by a wall 25 into at least two compartments or chambers, adapted respectively to contain, on the one hand supporting ropes 23, and on the other hand the parachute proper 26. The supporting ropes extend from one of said compartments to the other, through at least one orifice or aperture 27, which is capable of exerting a breaking action when the parachute is opening.

Whatever be the particular embodiment which is chosen, I obtain a system, the operation of which is sufficiently clear from the preceding explanations for making it unnecessary to enter into further explanations.

This system has, over systems of the same kind as used at the present time, many advantages among which the following may be cited as particularly interesting:

The stability of the parachutist as he is dropping freely before opening the main parachute, is perfectly ensured;

Furthermore, the operation of the whole system is particularly reliable.

In a general manner, while I have, in the above description, disclosed what I deem to be preferred embodiments of the present invention, it should be well understood that I do not wish to be limited thereto, as there might be changes made in the arrangement, disposition and form of the parts.

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G. DREYFUS
PARACHUTES
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Fig. 1

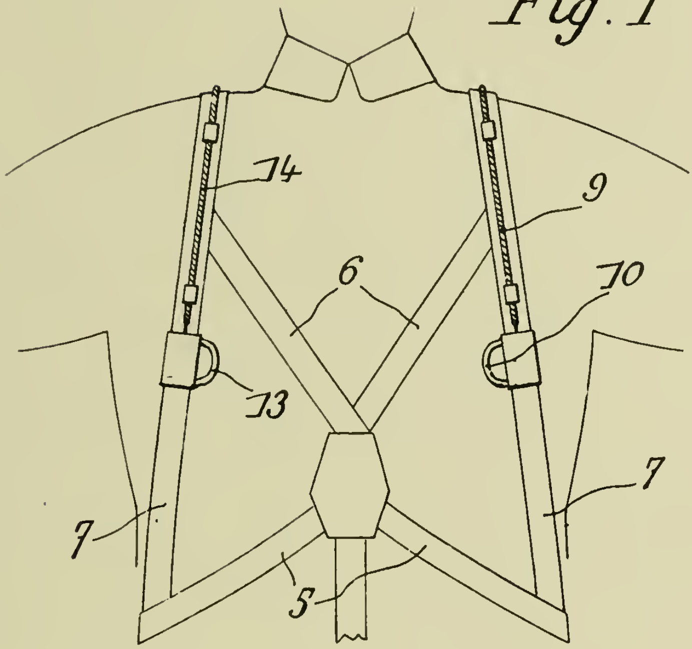

Fig. 2.

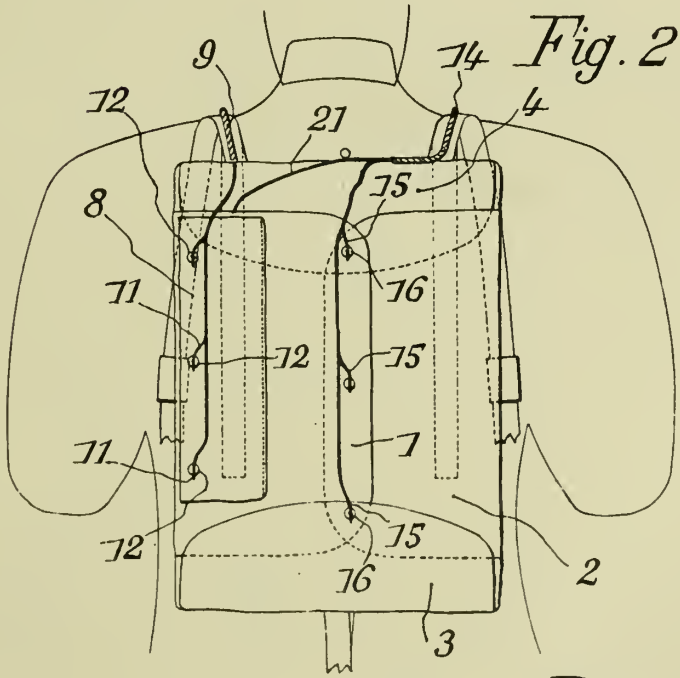

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Fig. 3.

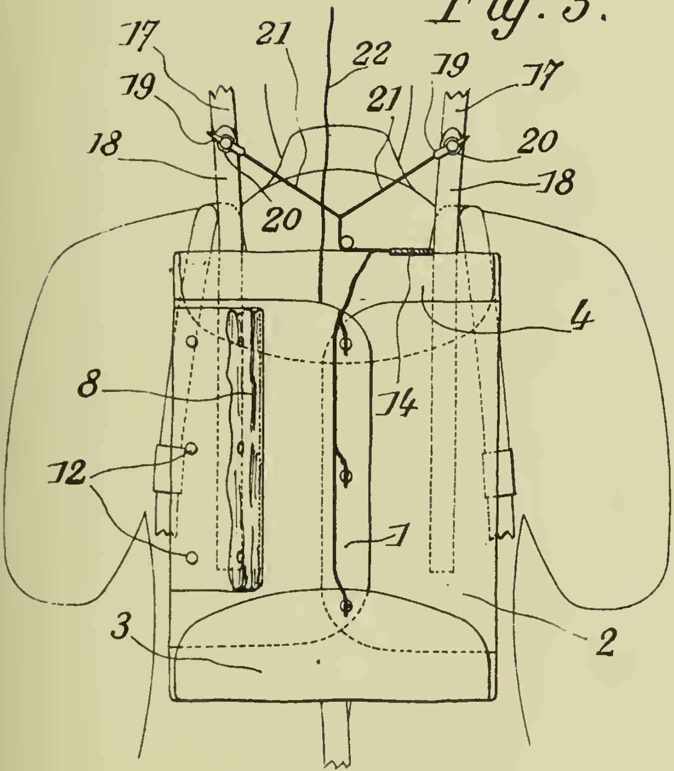

Fig. 4.

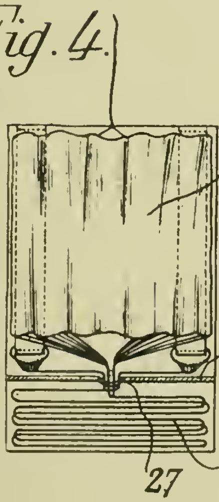

Fig. 5.

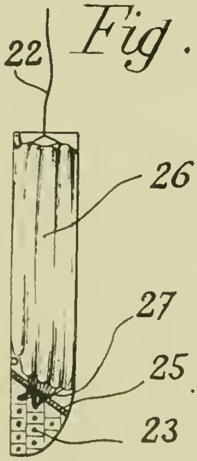

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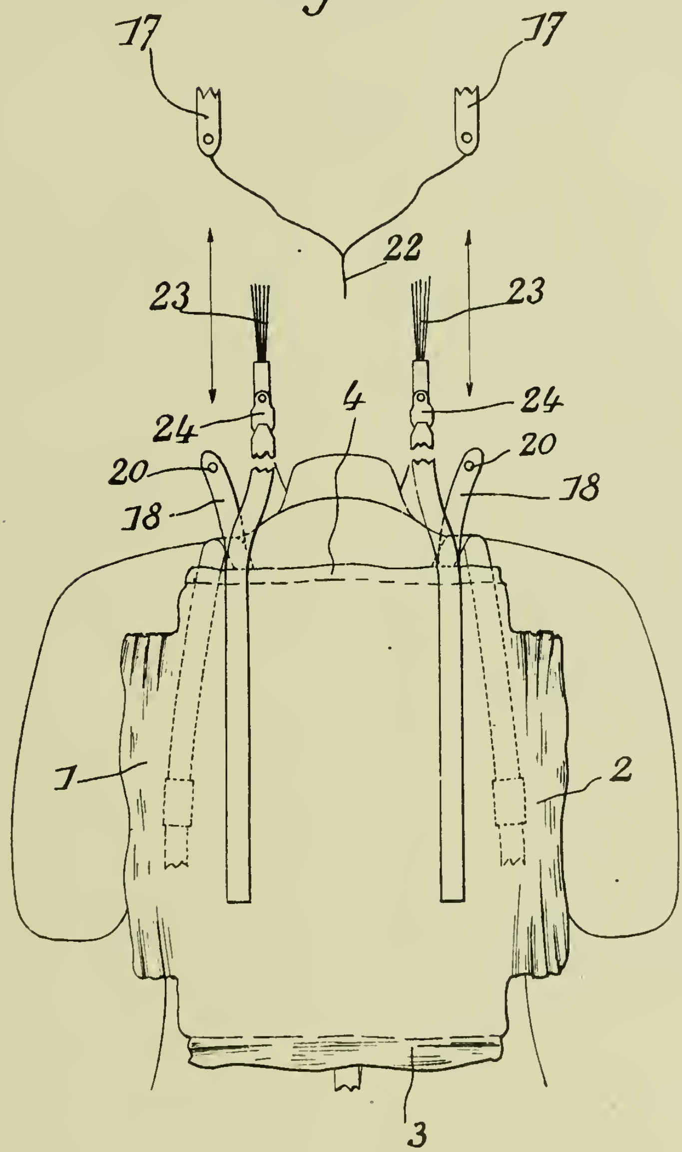
Fig. 6.



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ALIEN PROPERTY CUSTODIAN

PARACHUTE BELTS

Georges Dreyfus, Montauban, France; vested in the Alien Property Custodian

Application filed February 28, 1941

The present invention relates to parachute belts or harnesses of the type adopted to permit of adapting to the parachutist the whole of the parachute and of the various elements associated therewith.

The chief object of the present invention is to provide a belt or harness of this kind which is better adapted to meet the requirements of practice than those used for the same purpose up to the present time.

According to a feature of the present invention, which concerns adjustment devices to be provided in connection with the straps, and in particular the belts of the parachute equipments as above mentioned, such a strap is arranged in such manner that the movable end thereof is folded and bent double under the main portion of the strap and can be secured through means operable from the outside, in various adjustment positions.

According to an advantageous embodiment of the present invention, the securing means above mentioned consist of projections carried by the folded portion of the strap and extending outwardly through holes provided in the main portion of the same strap, said projections being held in position by spindles engaging therethrough and which can be easily operated.

According to another feature of the present invention which is more particularly intended for use in connection with parachute belts, said belts include, on the one hand a portion of fixed length and, on the other hand, at least one strap superposed to said first part and of adjusted length, this strap cooperating with the closing buckle of the belt.

According to still another feature of the present invention, in the case of parachute belts provided with a buckle, such as above mentioned, at least one of the elements of the buckle is mounted in a slidable manner to the belt or to an element, and especially a metallic element fixed therewith.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

A preferred embodiment of the present invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic perspective view of the whole of a parachute bag and the belt thereof, this system being made according to the present invention.

Fig. 2 is a corresponding partial view in horizontal section.

In the following description, I will explain my invention as applied to the case of an adjustable parachute belt to be used in connection with the parachute bag A. This parachute belt includes at least one strap, the ends of which are adapted to be fixed, for instance, to the male and female portions of a buckle B, capable of being closed and opened in a very quick manner. Of course, the ends of the strap, instead of being directly fixed to the parts of the buckle, might be fixed to elements rigidly assembled with said parts.

According to the invention, in order to permit of adjusting the length of the whole, one of the ends of said strap is folded inwardly, so that said belt portion is applied under the visible portion of the strap and is then fixed in the desired position through a suitable means adapted to be operated from the outside.

In the following description, it will be supposed that, according to still another feature of the invention, the strap is made of two portions, to wit:

(*a*) A first portion 1 of fixed length, which is attached permanently to the wall 2 of bag A; this part 1 is fitted, over at least a portion of its length and on the inner side thereof, with cushioning means 3; in the embodiment shown by the drawings, these cushioning means are provided at the front part of the belt; and

(*b*) A second part itself constituted by at least one and preferably two strap elements 4 of adjustable length, extending over the outer side of part 1.

The whole for instance arranged in such manner that straps 4 are fixed at one end to one of the elements 5 of buckle B, where they may be secured together with the corresponding end of the part 1 of fixed length. These straps run along this part 1, being suitably assembled therewith, and are fixed at their other end to the other element 6 of the buckle, with respect to which they are adjustable. The last mentioned end of strap elements 4 are freely mounted with respect to the corresponding end of part 1.

This part 1 is made of such a length that its ends can overlap each other.

The rear straps 4 preferably cross each other in such manner as to constitute at 7 a portion which is very strong and preferably of reduced width, so as to permit the passage and the fixation of the loop or other element to which the lower ends of the suspending ropes from the parachute are all attached.

The length of the belt is then adapted in each particular case, to the size of the parachutist, owing to the possibility of suitably fixing the ends of the strap elements 4 which are attached to elements 6.

For this purpose and according to the arrangement above described, the ends 4^1 are folded inwardly and they are adjustably fixed to the outer portion 4.

Advantageously, these fixation means are of the type including projections provided with holes and a spindle adapted to engage in said holes.

More specifically, this fixation device includes, for instance, as shown by the drawings, the following elements:

(*a*) On the one hand projections 8 carried by a part 9 mounted at the end of portion 4^1 of the strap, these projections 8 being adapted to extend through holes 10 provided in the strap; and

(*b*) on the other hand, a spindle 11, constituted by one of the branches of a hair-pin shaped clasp, the other branch of which engages for instance in part 9 which is correspondingly given the shape of a tube.

Finally, the whole is advantageously completed by means for guiding buckle B with respect to the belt. In the example shown by the drawings, these means consist for instance of a small projection 12 carried by elements 6 and guided on a strip of steel (or any other material) 13 fixed to belt 1. The position of element 6 on said plate depends upon the desired adjustment.

Whatever be the particular embodiment that is chosen, I obtain a system, the working of which results sufficiently clearly from the preceding explanations for making it unnecessary to enter into further explanations.

This system has over analogous systems used for the same purpose up to the present time, many advantages, the most important of which are the following:

I eliminate any out projecting strap portion; the adjustment of the belt on the parachutist is very easy,

The various pieces which are brought into place for the adjustment of the belt are perfectly guided,

The whole of the belt is extremely strong and can be relied upon for outstanding any stresses.

In a general manner, whilst I have in the above description disclosed what I deem to be preferred embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts, without departing from the principle of the present invention.

GEORGES DREYFUS.

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BY A. P. C.

G. DREYFUS
PARACHUTE BELTS
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Fig.1

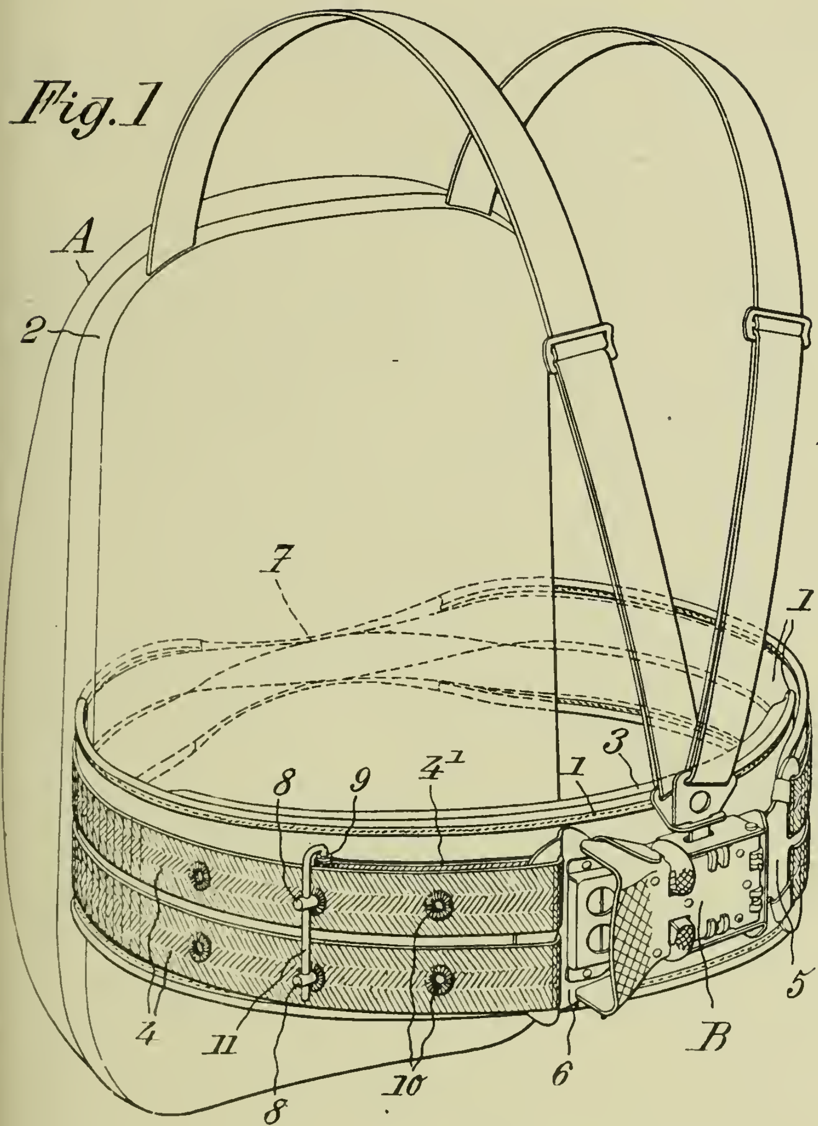
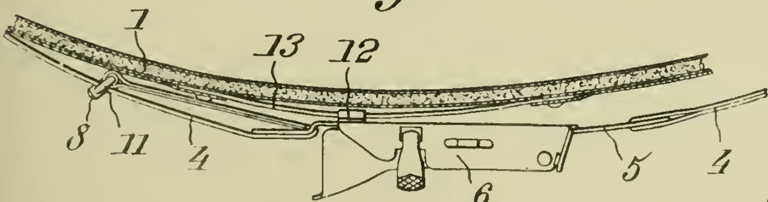


Fig.2



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Published June 8, 1943 Serial No. 382,283

ALIEN PROPERTY CUSTODIAN

MACHINES FOR COMPRESSING GASES BY CENTRIFUGAL EFFECT

Josef Szydlowski, Saint Pe de Bigorre, France; vested in the Alien Property Custodian

Application filed March 8, 1941

The present invention concerns machines for compressing gases by centrifugal effect, such as turbo-compressors and in particular the turbo-compressors utilised for supercharging the internal combustion engines on board aircraft.

Machines of this kind impart to the gas sucked in, a vis viva which is converted into static energy or pressure at the outlet.

It has been attempted, for all the applications of these machines, to obtain a high compression ratio, for a minimum cumbersomeness and weight, with an output as high as possible.

Fig. 1 of the accompanying drawings is a diagram of a known machine shown in axial half-section. The gas, for instance air, sucked through an inlet orifice O is drawn along in a rapid rotary movement by the blades of a rotor R and ejected at high speed into a manifold V or recovery volute chamber. Between the rotor and the volute chamber V, is interposed a suitable fixed blade D or diffuser, the function of which is to increase the output of the conversion of the vis viva of the air into static pressure.

The compression ratio between the inlet and the outlet increases with the angular speed of the rotor. This speed has for upper limit, the value which corresponds to a linear speed of the air at the end of the blades equal to the local speed of sound. Beyond this speed, the output of the machine rapidly lowers.

For avoiding this obstacle, it has been proposed to couple in several stages, machines working one after the other. That of the upper stage sucks in the air previously compressed by the machine at the stage immediately underneath.

A unit is thus obtained which is capable of ensuring a high compression ratio, whilst limiting in each machine, the compression work and, consequently, the angular speed of the rotor.

This arrangement however presents various inconveniences. In particular, the weight and cumbersomeness are exaggerated and, owing to the complication of the entire air circuit, the adiabatic and mechanical outputs are poor.

The present invention allows of obtaining a high compression ratio whilst avoiding the above mentioned inconveniences. It mainly consists in providing on one and the same rotor of a single machine, rings of concentric blades, that is to say of increasing diameters from the up side to the down side, between which are arranged fixed rings of blades which are simply guiding blades.

It is first of all obvious that a machine thus constituted causes the air to be subjected to an evolution comparable to that to which it is subjected in known compressors having stages. The air delivered by the first rotating ring, approaches the intermediate fixed blades which slow it down, the effect of which is to increase its static pressure.

The admission of the air into the second ring of rotating blades takes place at this static pressure and the kinetic energy imparted to the mass of air in said second rotating ring is again converted into pressure in the following fixed ring. The pressure thus increases from one to the other as in known stage machines.

Fig. 2 shows in axial half-section a machine according to the invention. The rotor of the machine comprises three rings or concentric sets of blades A^1, A^2, A^3. Two rings of fixed blades V^1 and V^2 are arranged between the rings A^1 and A^2 and A^2 and A^3.

In Fig. 3 which is a corresponding partial end view. α^1 is the angle of the air streams relatively to the vector radius of the machine, at the outlet of the set of blades A^1; α^2 is the angle corresponding to the air streams after they have been deviated by the fixed set of blades V^1.

It will immediately be seen that if α^2 is smaller than α^1, the movement of the air is slowed down and a part of its kinetic energy is converted, by the set of blades V^1, into potential energy. On the other hand, it will be seen that the set of blades of the stage immediately above A^2, is fed with a lower circumferential speed (proportional, for an equal output, to $tg\alpha^2$). The application of the theorem of the impulse moments then shows that the increase of pressure produced by the set of blades A^2 is so much the greater as α^2 is smaller. The conclusion is the reverse if α^2 is greater than α^1.

If the blades of the fixed rings V^1 and V^2 are pivotally mounted on suitable spindles, by setting them accordingly, the rotating set of blades immediately following them can be charged or discharged at will.

When the invention is applied to the supercharging of an aeroplane engine, from the ground up to the so-called balance altitude, this circumstance is particularly advantageous. The required compression ratio is in fact very variable according to the altitude at which the aeroplane is flying. The blades such as V^1 and V^2 can be adjusted in such a manner that they slow down the air or accelerate it. The following set of blades (A^2 or A^3) might then be discharged, even until it operates as a turbine.

The torque borrowed from the engine will thus be reduced to the strict minimum necessary for

supplying the engine at its nominal admission pressure. This reduction of the torque is so much the more substantial as the aeroplane flies at a lower altitude.

By limiting the number of stages to two, the compressor of the present invention has a diametral cumbersomeness equal or scarcely greater than a single-stage compressor of the same category. The longitudinal cumbersomeness remains the same as that of a single-stage machine.

Figs. 4 to 6 are views similar to Fig. 2 for embodiments of turbo-compressors improved according to the invention. In the example of Fig. 4, the rotor comprises, in the manner known per se, helical blades E on the up side of the set of blades A^1 and A^2 according to the invention. These sets of blades E are adapted to bring the air without shock to the inlet of the set of blades A^1. The air is admitted in the machine through shutters E^1 which can be set, also in the known manner and which, in the machine according to the invention, add an adjustment of the pressure ratio to that produced by the ring V^1.

The adjustment by means of the shutters E^1 can be done away with and the intermediate blades V^1 between both stages need only be maintained as regulating system. In this case helical wheels E are preceded only by an axial or radial axial channel provided or not with a fixed guiding set of blades.

The control of the orientation or setting of the blades such as V^1V^2 can be, in the various embodiments, independent for each ring, or can be obtained by combining the controls of the various rings. Said control can be automatic from any desired variables.

The admission of air can also be effected through a volute chamber E^2, opening into an axial or radial channel (Fig. 5). The inlet shutters E^1 are done away with and the angle of incidence of the first helical wheel E is constant. Its value results from the suitable adaptation of the main section of the volute chamber to that of the channel. This method of construction is more particularly suited to radial type engines.

A single-stage and simply radial compressor can also be devised (Fig. 6) obtained by doing away with all the driving members preceding the fixed intermediate sets of blades V^1. The admission of air takes place, in this case through the axial channel occupied by the helical wheels E in the preceding examples. This channel can open directly to the free air or be connected to an inlet volute chamber or to a radial channel.

JOSEF SZYDLOWSKI.

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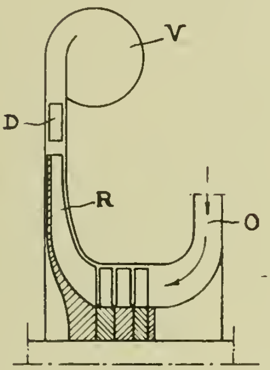
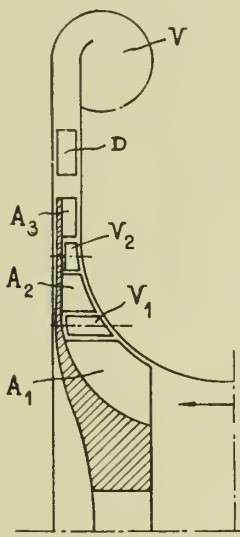
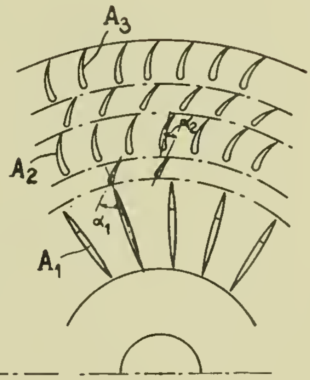
.Fig.1.



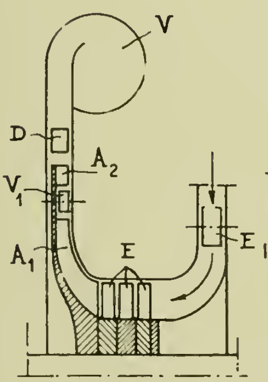
.Fig.2.



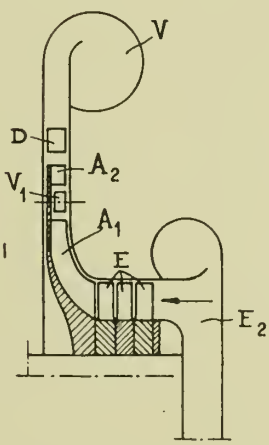
.Fig.3.



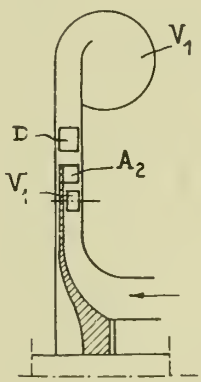
.Fig.4.



.Fig.5



.Fig.6.



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ALIEN PROPERTY CUSTODIAN

MACHINES FOR DISPLACING AND COMPRESSING FLUIDS, SUCH AS TURBO-COMPRESSORS FOR FEEDING AIRCRAFT ENGINES

Josef Szydlowski, Saint Pe de Bigorre, France; vested in the Alien Property Custodian

Application filed March 8, 1941

The present invention concerns machines for displacing and compressing fluids, such as turbo-compressors for feeding aircraft engines.

For allowing a gain in weight to be obtained, said turbo-compressors are permanently coupled to a shaft of the engine, and the angular speed of their rotor is that of said shaft. On the ground, or at low altitude, the turbo-compressor does not produce any appreciable useful effect; it absorbs without benefit a part of the power of the engine.

If C_1 is the tangential component of the speed of the fluid at the inlet of the rotor,

C_2 the tangential component of the fluid at the outlet,

r the corresponding radius of C_1 at the inlet,

R the radius corresponding to C_2 at the outlet, the torque absorbed by the machine per unit of weight of the fluid is proportional to:

$$P=C_2R-C_1r$$

The value of P, and consequently, that of the power absorbed, can be theoretically lowered:

By giving to the term C_1r an absolute value as near as possible to that of C_2R.

But, C_1 cannot exceed an upper limit which is the speed of sound. For practical reasons, r cannot be as great as R.

By giving C_2 a value approximating C_1.

But this solution is inadmissible since C_2 which must subsequently be converted into pressure must be as high as possible.

In altitude, it is necessary to increase as much as possible the pressure generated by the machine and, consequently, the value P and, as the working speed of the engine, that is to say, the angular speed of the rotor of the turbine, as assumed, remains constant, in order to do so, a negative value is given to C_1r (C_1 being in this case limited below the speed of sound). The torque absorbed by the machine becomes proportional to:

$$C_2R+C_1r$$

The invention has for its object or industrial result, to reduce on the ground or at low altitude the difference:

$$C_2R-C_1r$$

and to increase, at high altitude, the sum:

$$C_2R+C_1r$$

For that purpose, the invention mainly consists in imparting to the fluid, at the outlet of the part of the rotor having purely a centrifugal action, a tangential component of variable value, negative or positive, which constitutes the tangential component of admission into a second machine, and so on.

This definition of the principle of the invention results in the fact that, if C_3 is the tangential speed of the radius r_3 at the inlet of the second machine, the two values:

$$P=C_2R-C_1r \text{ on the ground}$$

and

$$P_a=C_2R+C_1r, \text{ in altitude}$$

become respectively:

$$P_3=C_2R-C_1r-C_3r_3, \text{ on the ground}$$

and

$$Pa_3=C_2R\pm C_{1a}r+C_3r_3, \text{ in altitude}$$

With a structure of n machines arranged according to the invention, will be obtained:

$$P_n=C_2R-C_1r_1=C_3r_3 \text{ - - - - - - - - - - } -C_nr_n$$
$$Pa_n=C_2R\pm C_{1a}r+C_3r_3 \text{ - - - - - - - - - - } +C_nr_n$$

As regards the construction, the invention consists in associating the machines in such a manner that the inlet of one is connected to the outlet of the preceding one, doing away with the usual diffuser placed at each outlet and maintaining only the inlet guiding blades which impart to the fluid the required tangential component.

The single figure of the accompanying drawing illustrates, by way of example only, a form of construction of a turbo-compressor having two rotors, according to the invention. This figure is a somewhat diagrammatic axial half-section, of the machine.

The inlet of the machine is provided on the periphery of the ring **1** in which are arranged the blades **2** pivoted about spindles **3** so as to be set in such a manner that they impart to the fluid the required tangential component. The outlet is provided at **4**, through the usual diffuser **5**.

On the same driving shaft **6** mounted in the bearings **7** and **8** of the casing **9**, are rigidly secured two rotors, each of which has the main arrangement of known machines and comprises, on the one hand, distinct sets of blades **10**, **10**$_a$, **10**$_b$, the main function of which is to avoid separations noticed in the curved surfaces on the up side of turbo-compressors and, on the other hand, radial sets of blades **11** having purely a centrifugal action.

For obtaining a continuous path for the fluid with the minimum deviation, the outlet **12** of the first rotor is mingled with the inlet of the

second rotor, guiding blades **2**a pivoted about spindles **3**a allowing to impart to the fluid, when it enters the second rotor, the required tangential component, for the purpose described in the preamble to the present specification.

The machine illustrated comprises only two rotors, but it is obvious that it could be provided with a greater number.

The diagrammatic illustration contemplated comprises a disc **13** separating both rotors, rotating with the shaft **6**, the spindles **3**a of the guiding blades being supported, on the one hand, on the casing **9** and, on the other hand, by means of a ring **14** connected by narrow arms **15**, suitably profiled, to the casing **9**.

This arrangement is only given by way of indication and the disc **13** might be done away with, and the spindles **3**a mounted in overhanging position on the casing **9**.

The control of the orientation or setting of the blades **2**a can be independent from or combined with that of the blades **2**.

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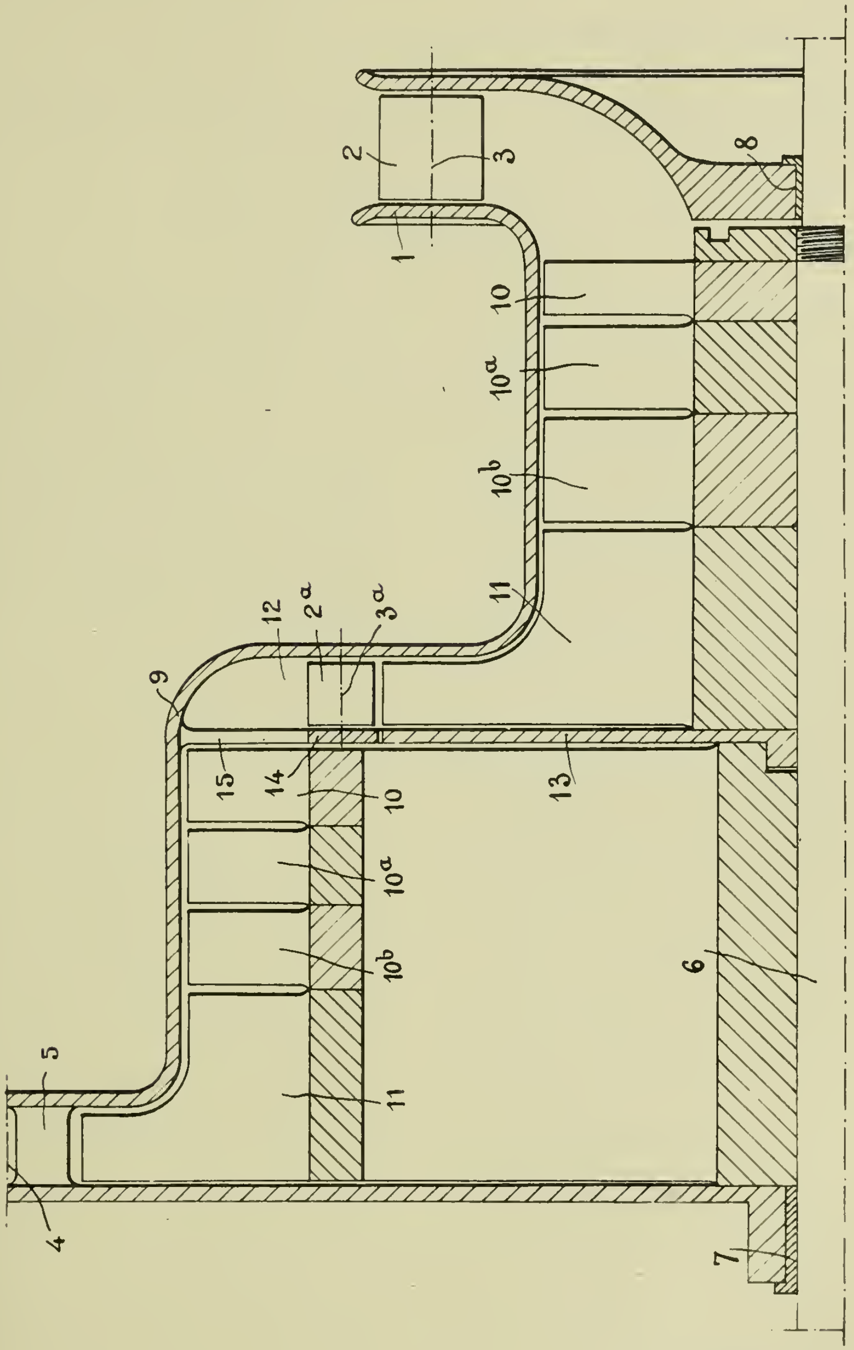

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ALIEN PROPERTY CUSTODIAN

CARRIER FREQUENCY RECEIVERS

Heinz Hannemann, Berlin, Germany; vested in the Alien Property Custodian

Application filed March 13, 1941

The receiving apparatus employed for the reception of several channels are in general divided into two groups, no matter whether the channels to be received are transmitted by wire or by radio. These groups are as follows:

(1) Systems arranged to receive intelligence selectively, that is through one or another channel to the exclusion of the others, such as wired radio and broadcast reception, for instance.

(2) Systems to receive intelligence through all of the channels at the same time, such as the terminal apparatus of multiple carrier frequency connections, these likewise being either wired or wireless.

In the case of receiving systems belonging to (group 1) two items are of special importance, namely,

(a) The sharpness of separation, that is, the attenuation of the cross-talk affecting the channel of reception,

(b) The band width of the channels.

The receiving devices known in the prior art involve a considerable expenditure in electric and mechanical means if it is desired to insure a high-grade reception of each channel. As a rule, receivers of this kind comprise an electron tube stage or several such stages and between these tube stages there are provided coupling elements which comprise either resonant circuits, tuned to the received frequency, or wave-band filters. In this connection it has been found that the selectivity or cross-talk attenuation obtainable by means of a resonant circuit cannot be utilized completely because on account of the transmitted band of the reception channel the resonant resistance of such circuit may not be given any desirable magnitude. Therefore, in order to provide for a sufficient cross-talk attenuation the practice has been to employ a number of resonant circuits tuned to the received frequency. The tuning of these resonant circuits must be variable in accordance with the received frequencies distinguishing from each other. To such end, means for tuning each circuit individually may be provided or correcting condensers may be employed, or means for a gradual variation of self-induction and capacity of the circuits may be used. However, all these expedients considerably complicate the receiving device.

The same applies for the use of interchangeable band-filters with constant band width. Especially in the case of transmitting systems comprising many channels these band-filters constitute a great expenditure in filters and in complicated switching devices.

The prior receiving devices also have the disadvantage that the non-linearity of the tubes arranged in the receiving system entails cross-talk between the channels.

According to the present invention the amplification effected by vacuum tubes whose outer resistance constitutes a resonant circuit is with the aid of the anti-coupling principle made to be controlled by frequency.

The invention renders it possible to do away with the undesirable interrelation of band width and cross-talk attenuation and to insure an efficiency of reception which heretofore required the use of an arrangement much more complicated than the novel one. The novel arrangement also acts to minimize cross-talk caused by the non-linearity of the tubes.

In the drawing, Fig. 1 is a diagram showing one embodiment of the invention. Figs. 2 and 3 are graphs referred to in explaining the operation of this embodiment. Fig. 4 is a diagram illustrating another embodiment. Figs. 5 and 6 are graphs which relate to the function of the arrangement represented in Fig. 4. Figs. 7 to 11 illustrate still other embodiments of the invention.

As indicated in Fig. 1 the frequencies f_1, f_2, f_3 . . . f_n of n channels are conveyed to the grid of a vacuum tube E. The outer resistance of tube E is a parallel resonant circuit K_E tuned to the received frequency, such as f_2, for example. In the grid-cathode circuit an impedance W is arranged to effect the anti-coupling. This impedance is dependent on frequency and comprises as many parallel resonant circuits B, connected in series, as there are frequencies not received. In accordance with the frequency-controlled behaviour of the impedance W, this behaviour being illustrated in Fig. 2, the amplification due to the vacuum tube is less than in the case of the received frequency f_2. This result is attributable to the anti-coupling which is effective in the case of the frequencies f_1, f_3 . . . f_n not being received. Accordingly, the selectivity of the receiver is increased without the transmitted frequency band becoming reduced. The electrical dimensions of the resonant circuit K_E may hence be calculated to amplify a frequency band of definite width.

Fig. 3 shows the amplification curve 1 of this arrangement and also illustrates the amplification curve 2 that results in case the impedance W is short-circuited, the anti-coupling thus being rendered ineffective. If the drop of amplification between the received frequency f_2 and frequency

f_1, for instance, amounts to s_1 nepers with short-circuited impedance W then in the case of anti-coupling the drop of amplification is s_1' nepers. The novel arrangement thus acts to increase the selectivity between the received frequency f_2 and frequency f_1, for instance, by $s_1' - s_1$ nepers.

Instead of the impedance W, composed of the parallel resonant circuits B connected in series, an impedance W', Figs. 4 and 5, comprising a choke D*r* and a series resonant circuit K, may be employed, these two being connected in parallel. Also here the outer resistance of tube E is a parallel resonant circuit K_E tuned to the received frequency, such as f_2. The switching-over necessary for receiving a frequency to the exclusion of the others may be effected by varying the inductances or capacities of the two resonant circuits. The curve of the impedance W' for the reception of f_2 is represented in Fig. 5. The series resonant circuit K is tuned to the frequency of reception f_2 so that with this frequency the impedance of the arrangement D*r*, K acquires a minimum value, that is to say, in the case of the received frequency the anti-coupling is not effective. The other incoming frequencies, however, being either higher or lower than the received frequency, are anti-coupled because in the case of these other frequencies the impedance W' increases from its minimum value onward towards both sides. In Fig. 5 it has been assumed that the frequency f_2 is being received. In Fig. 6 the curve 1 shows the selectivity of the receiver with the anti-coupling effective, while curve 2 illustrates the selectivity thereof in the case of no anti-coupling. For instance, between the received frequency f_2 and frequency f_1 the rise in selectivity amounts to s_1'—s_1 nepers.

The idea on which the arrangements shown in Figs. 1 and 4 are based may also be employed in receiving systems of the kind comprising several tube stages E_1, E_2 etc., as represented in Figs. 7 and 8 by way of example.

In the case of wired radio three carrier frequencies are conveyed to the receiver. The carrier oscillations are transmitted by transmitting their two sidebands. The carriers are spaced apart by a distance of about 30 to 40 kilocycles per second and belong to the broadcast long-wave range. The bands to be transmitted to broadcast receivers comprise values from 30 to 10,000 cycles. The aforesaid relations between transmitted bandwidth and cross-talk attenuation must here be carefully considered. The following receiver arrangement, based on the described invention, is suggested: the parallel resonant circuits B included in the grid-cathode conductor, Fig. 1, and tuned to the frequencies not received, and the parallel resonant circuit K_E tuned to the received frequency and constituting the anode resistance are interchanged in cyclic fashion by means of a suitable switch if the frequencies $f_1, f_2, f_3 \ldots f_n$ are to be received in succession. Another advantage of this arrangement is that everybody, even if not skilled in the art, will be able to readjust the receiver in the event of local disturbing frequencies causing the carrier frequencies to distinguish from the normal ones, this advantage being due to the fact that there is only one circuit for each frequency.

In order to apply the invention to the trap circuit of a broadcast receiver the arrangement may be as follows:

In the customary devices a resonant circuit, the so-called trap or rejective circuit, tuned to the interfering transmitter, is included in the antenna lead to the receiver. According to the invention a parallel resonant circuit is provided in the cathode lead, namely, a circuit whose resonant frequency accords with the frequency of the interfering transmitter and thereby acts appreciably to increase the rejective action.

In the case of push button receivers having tuning circuits arranged to be switched over the invention renders it possible to simplify such switching over and the tuning operation, as only one tuning circuit is necessary for effecting a sufficient sharpness of separation.

With the receiving devices customary in the carrier frequency art concerned with the transmission of several channels, the channels are jointly amplified by a wide band amplifier. As will appear from Fig. 9, the channels are separated from each other, after amplification, with the aid of filter circuits, such as F_1, F_2, F_n, arranged in the output circuit of the wide band amplifier.

By employing the principle of frequency-controlled anti-coupling the advantage results that the mutual separation of the channels is not effected by means of the definitely tuned filter circuits but, as shown in Figs. 10 and 11, is effected with the aid of an anti-coupled tube stage E' the tuning of which is variable. At the same time the tube stage E' acts to amplify the selected channels so that the expenditure in tube stages for the wide band amplifier may be reduced or the amplifier may eventually be dispensed with.

By suitably calculating the electric dimensions of the parallel resonant circuits B' connected to the cathode, Fig. 10, it is possible to arrange that tuning circuits will be necessary only for those channels which are in the neighbourhood of the received channel.

HEINZ HANNEMANN.

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H. HANNEMANN
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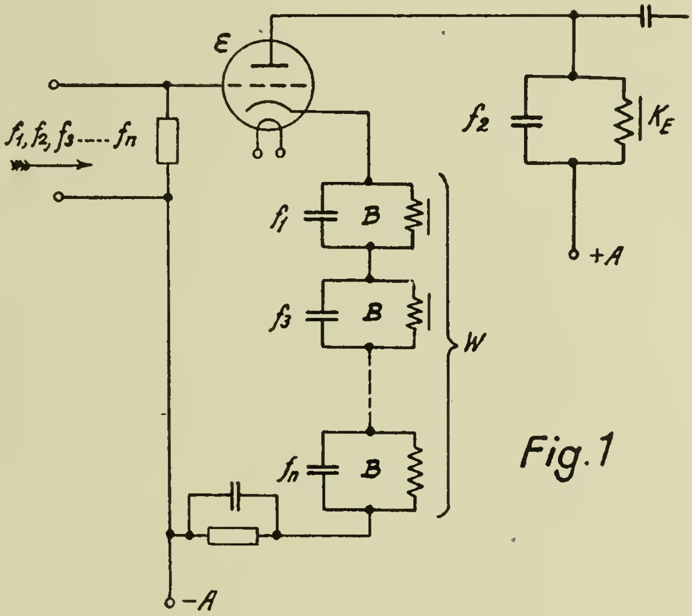
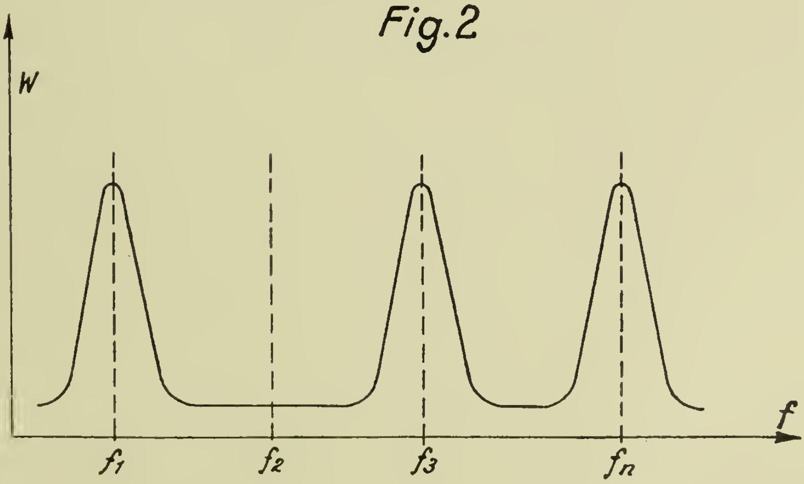


Fig.1

Fig.2



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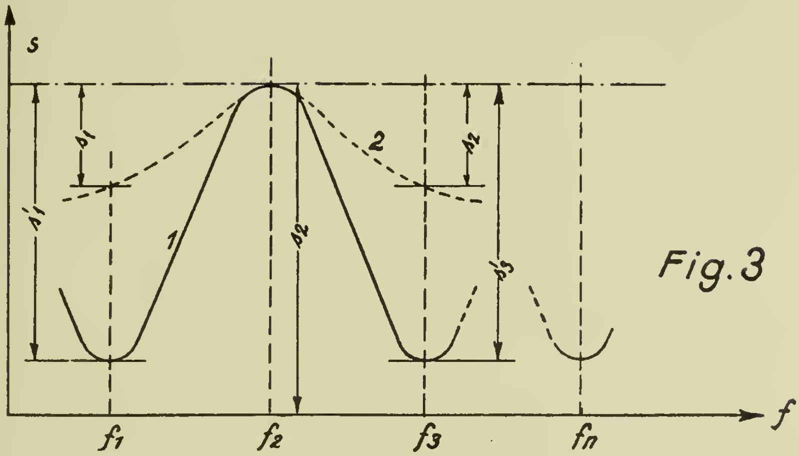

Fig. 3

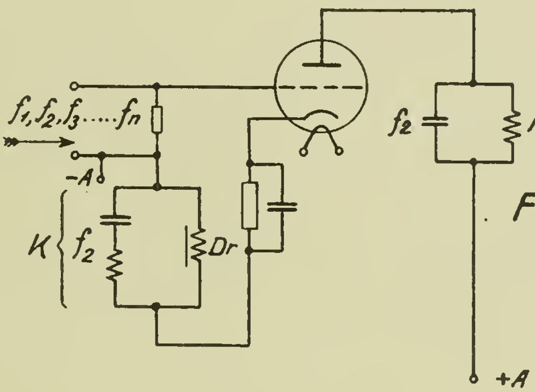

Fig. 4

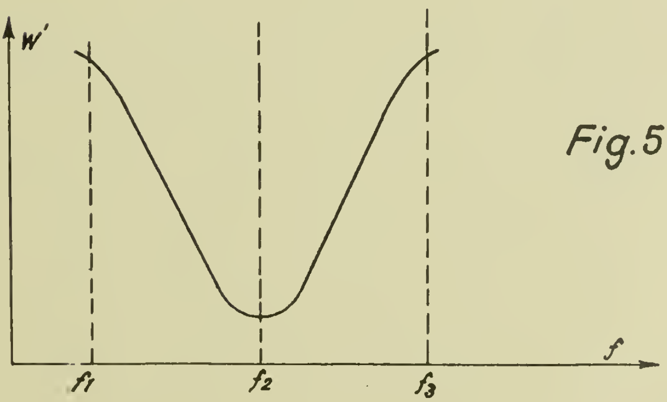

Fig. 5

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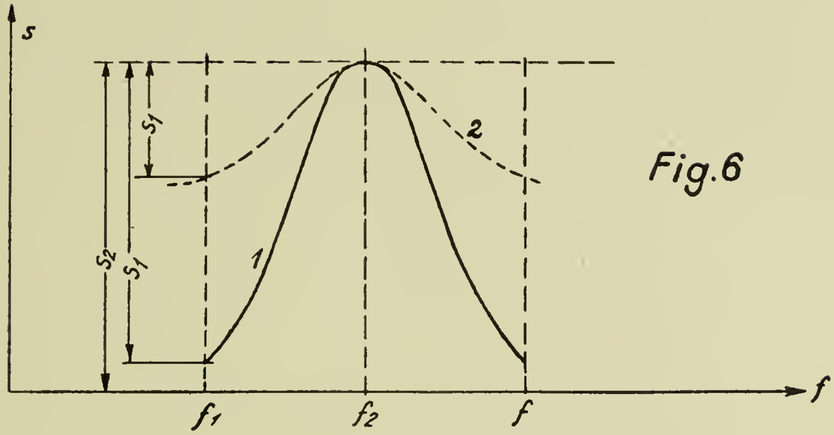

Fig. 6

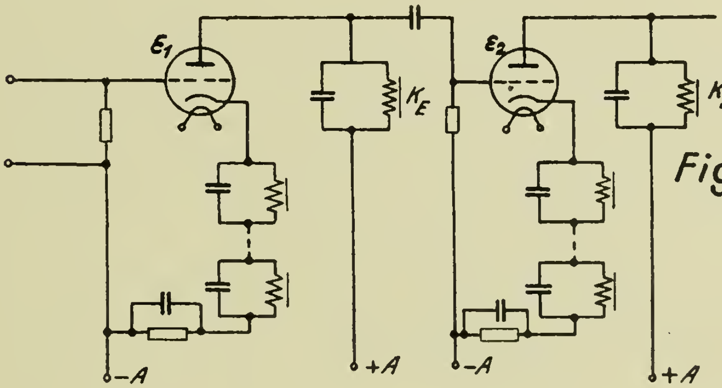

Fig. 7

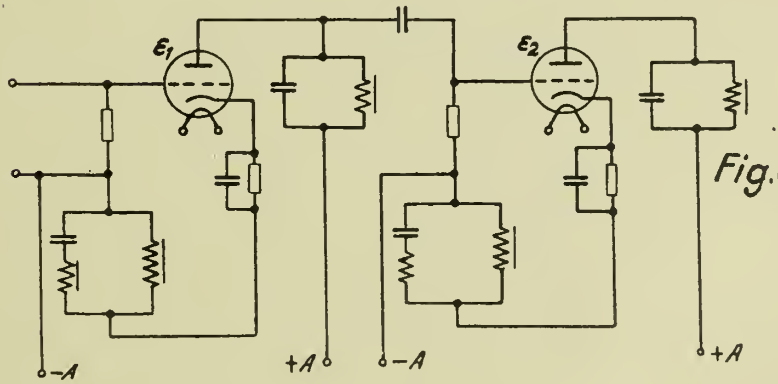

Fig. 8

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5 Sheets-Sheet 4

Fig. 9

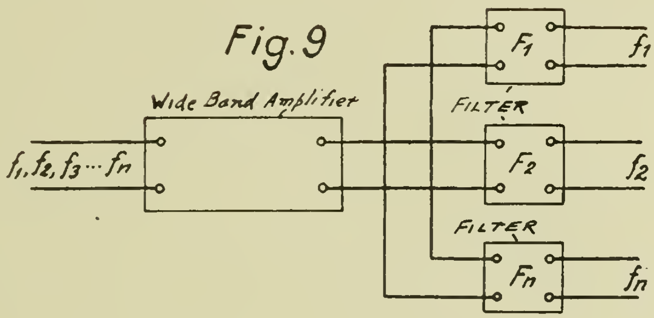
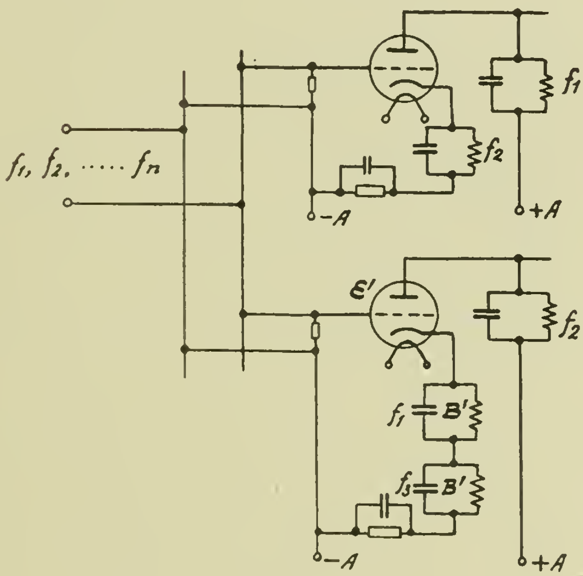


Fig. 10



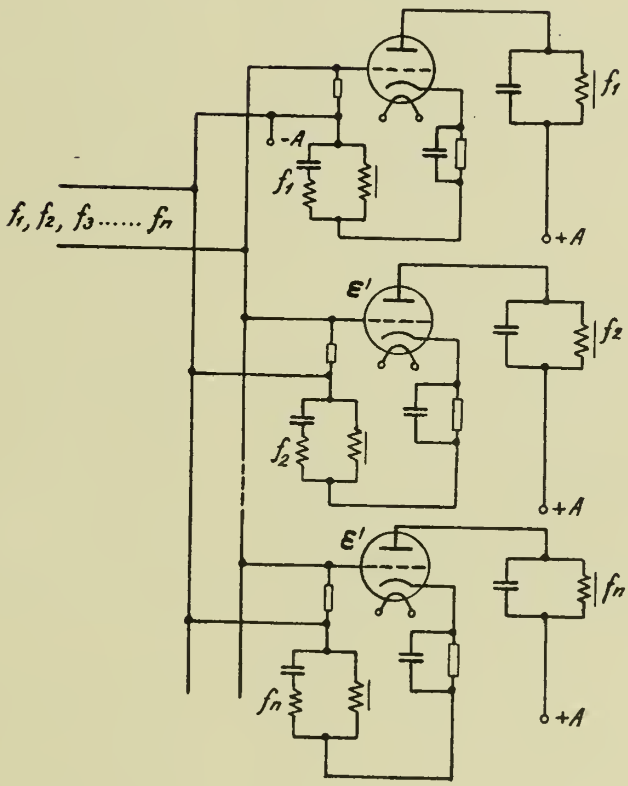
Inventor:
Heinz Hannemann
by [signature]
Att'y

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

H. HANNEMANN
CARRIER FREQUENCY RECEIVERS
Filed March 13, 1941

Serial No.
383,162
5 Sheets-Sheet 5

Fig. 11



Inventor:
Heinz Hannemann
by [signature]
Att'y

Published June 8, 1943

Serial No. 386,196

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR PERMANENTLY CHECKING THE WORK OF OPERATORS

Robert Sarazin, Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed March 31, 1941

In his French Patent No. 759,150 of 22nd October, 1932, the applicant described a device for checking the activity of operators and in particular of welders, by recording the work effected during the day and counting the electrodes.

Said device thus enables, for a given operation, the various elements to be obtained which constitute the cost price of a weld and also the diligence of the operator to be characterized.

However, the device described in the aforesaid French Patent involves a rather delicate mechanical arrangement, the upkeep of which may not be very well effected by the normal welding shop.

The present invention provides a novel means for permanently checking the work of the operators and consists, in principle, in using for the printing of recording documents which are prepared for this purpose, the luminous or non-luminous rays directly or indirectly emitted by the working tool; this one, in the second case, operates an auxiliary member which emits the necessary rays for operating the apparatus.

In the case of the arc welder, for example, the rays emitted by the source are very actinic and act very intensely on photographic papers or even on sensitized papers such as those which are used for reproducing drawings.

In this practical application of the invention, use may be made of a recording paper which is partly or completely covered with an emulsion which is sensitive to the rays of the arc and a part of the surface of this sensitive zone is exposed to said rays during the entire duration of the fusion of an electrode. A similar arrangement may be adopted during the time of supervision of a furnace, for example, if it is desired to check the operator entrusted therewith.

The advantage can be seen which is offered by the possibility of using slightly sensitive papers which are cheap and easy to develop. They require a fairly long exposure and if the luminous source has to be modified, it is an easy matter to provide a coloured glass screen which will proportion the luminous power required for satisfactory printing.

This recording process therefore leads to ensuring the translation of a sensitized paper in front of an opening which may moreover be provided with a rudimentary lens. By moving the sheet of paper in front of the opening, as a function of the time, it will be possible to represent graphically the work of the operator.

After the day's work has been effected, the operator hands his diagram to the foreman or to the man in charge of production; by simply passing this document in a suitable developer, the various factors showing how the time has been used will become apparent.

A quick count of the lines printed on the paper, representing the fusion of each electrode, will show the number of electrodes actually used; if, on the other hand, the movement of the paper has been effected as a function of the time, the responsible foreman will be able to check the diligence at his work, in one word the efficiency, of each operator.

The printed paper may be filed so as to form a kind of time register which may be referred to, when identical work is being effected.

Various embodiments may be contemplated. However, by way of demonstration, two chief embodiments have been shown which particularly refer to the case of arc welders.

It is known that this welder generally holds in his hand, no the one hand, a protecting screen, on the other hand the holder provided with the electrode which, by melting, will form the supply of metal for the weld.

The two movements are automatically combined at the instant when the welding operation is effected. The operator normally holds his electrode-holder in the right hand, and in the other, he takes the handle of the screen which is to protect him from the rays.

In the most general case, the welder effects these two movements almost simultaneously and, at the instant when he strikes the arc, he brings the screen in front of his eyes. Thus, for each new electrode, the operator will take hold of his screen and this movement may be used to obtain a displacement of the recording paper; the latter may be placed in a rudimentary camera mounted on the face of the screen for example.

In the accompanying drawing, two embodiments have been shown of a device possessing the above features:

Fig. 1 is a back view,

Fig. 2 a view in vertical section along the plane projected on X—X in Fig. 1,

Fig. 3 is a view, in horizontal section along the plane projected on Y—Y in Fig. 1, of a first embodiment of the device;

Fig. 4 is a specimen of recorded diagram obtained with the device;

Fig. 5 is a view in diametral section of another embodiment of the apparatus;

Fig. 6 is a recorded diagram corresponding to said apparatus.

In Fig. 1, the recording paper I is formed by a kind of rectangular card covered, on its face

exposed to the arc, with an emulsion of a product which is sensitive to the rays of the arc. The camera is, for example, represented by the simple slideway 1a which is applied against the inner face of the screen E provided with its usual window F; on the front face of the slideway, which is exposed towards the arc, there is provided a slit **2** which is of the required length and height for obtaining the printing of a line.

In front of the slit **2**, the possibility has been provided of placing a coloured screen **3**, in such a manner that only a source of light which is as powerful as an electric arc can affect the paper. The coloured screen is so chosen that the darkest shade of the line requires an exposure corresponding to the time of melting of the electrode used; it will therefore be possible to adapt the screen to the intensity of the source of light, that is to say to the diameter of the electrode.

The apparatus is completed by a very simple mechanical system comprising, for example, an actuating drum **4** covered for example with rubber, which moves the card a space longitudinally after each electrode, so that the apparatus is ready for further use.

Each time the operator takes hold of the screen again, he actuates the mechanical system, for example by means of a small ratchet device **5** actuated by the small spindle **6** secured to a blade **7** which forms a lever and is placed against the handle **8** of the screen; by grasping the handle of the screen, the operator cannot fail to press the blade **7** and the latter feeds the recording card a predetermined amount, then returns backwards.

In the case in which the operator uses a helmet covering his head, he is in the necessity of either moving it backwards, or opening it in order to see and pick up a fresh electrode; the corresponding movement will in this case be used for moving the card as has been described.

The system thus obtained is the simplest. After treatment of the sensitized paper, it produces a card according to Fig. 4 bearing a series of lines, the intensity of shade of which measures the time of exposure, that is to say the time of melting, it being observed that with the same screen and for given conditions of operation, the successive lines should be similar. Said card may bear complementary indications concerning the work.

The second device, which is illustrated in Figs. 5 and 6, shows a construction of a different design but having the advantage of recording the elementary times of work as a function of the time of presence in the workshop.

The sheet of paper is shaped like a disc **9** mounted on the plate **10** of a clock motor **11** which rotates it a complete revolution in a period of time chosen as being the most suitable for the checking.

The whole arrangement is enclosed in a casing **12** which carries the slit **12**a; for some sources of light, it may be advantageous to replace the slit by a suitable small lens which receives the rays emitted by the source and directs them in a parallel or convergent beam to produce a line or else to determine a point.

Assuming that the rotation of the disc is effected in twelve hours, which covers a day's work with interruptions, it will be seen that the foreman will be aware of all the incidents of the day with its periods of work and its stoppages. As regards the arc welder, for example, the fusion of the electrodes will be recorded, with the device according to Fig. 5, in successive bars which are directed along clements that may be assimilated to radii.

It is easy to complete the apparatus described above by mechanical auxiliary devices which could direct the record, for example in the shape of an arc of a circle or according to any other outline.

In this case, the use of a luminous point instead of a narrow beam would determine a section of circle of fairly great length, which would give better legibility.

It will be seen from the explanation that the apparatus can be used for checking all kinds of operations. For this purpose, it would be completed by various electrical or mechanical members which exist in the present state of the art and do not themselves fall within the scope of the present invention.

ROBERT SARAZIN.

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BY A. P. C.

R. SARAZIN
APPARATUS FOR PERMANENTLY CHECKING
THE WORK OF OPERATORS
Filed March 31, 1941

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386,196

Fig. 1.

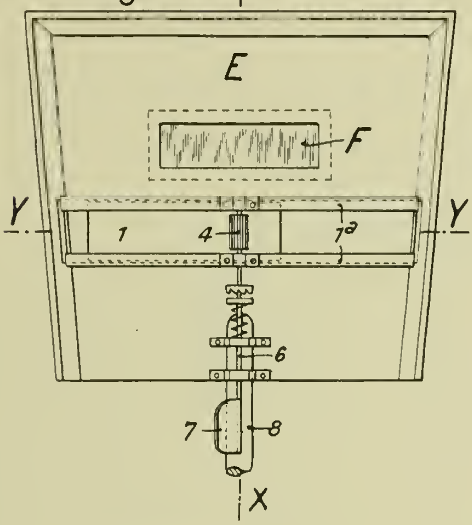


Fig. 2.

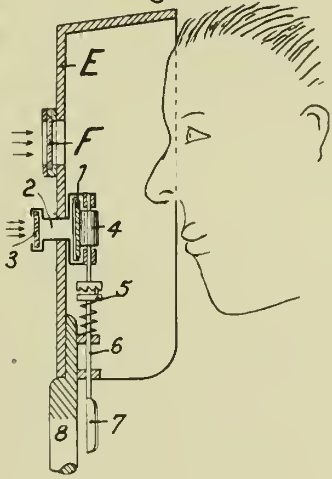


Fig. 3.

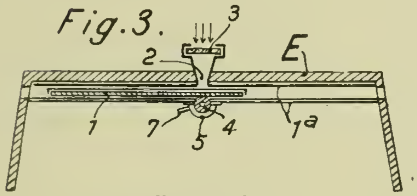


Fig. 4.

Fig. 6.

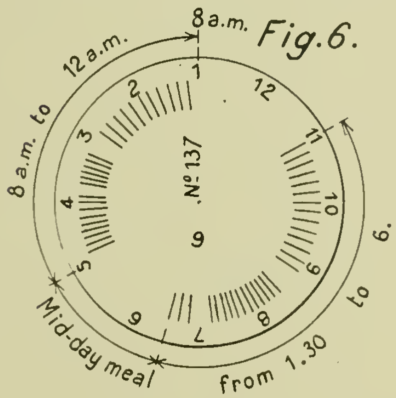
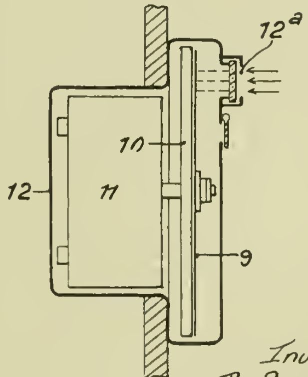


Fig. 5.



Inventor,
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Published June 8, 1943 Serial No. 388,644

ALIEN PROPERTY CUSTODIAN

METHOD OF PRODUCING SOLUTIONS OF CHLORIDES OF POLYVINYL

Maurice Louis Auguste Fluchaire, Lyon, France; vested in the Alien Property Custodian

No Drawing. Application filed April 15, 1941

This invention relates to a Method of Producing Solutions of Chlorides of Polyvinyl and to the new industrial products resulting therefrom, the principal object of the invention being to provide solutions of chlorides of polyvinyl or its derivatives in cyclopentanone.

The chlorides of polyvinyl have certain very interesting properties which render them valuaable as adhesive material, varnish and for all uses of plastic materials in general. Such chlorides however are not soluble except in a small number of solvents and, for varieties in degree of high polymerisation, the number is still more limited. Among the rare solvents for chloride of polyvinyl, one of the more usual is cyclohexanone.

The applicant has found,—and it is that which constitutes the object of the present invention,—that cyclopentanone and its derivatives constitute, for chloride of polyvinyl, and particularly chloride of polyvinyl of a high degree of polymerisation, solvents superior to cyclohexanone. This superiority manifests itself particularly by the fact that with an equal concentration of chloride of polyvinyl, the solutions in cyclopentanone are less viscous than solutions in cyclohexanone, that is to say, the solid contents of a solution of chloride of polyvinyl in cyclopentanone is higher than that of a solution in cyclohexanone presenting the same viscosity.

Such difference in behavior was not predictable from what was heretofore known of these substances. Cyclopentanone and cyclohexanone have in effect been regarded as solvents of various substances such as natural resins, cellulose esters, etc. But the two solvents have been until the present time considered as equivalents and there was no reason to suppose that in the case of chlorides of polyvinyl one of them would show a clear superiority over the other.

The placing in solution of chlorides of polyvinyl in cyclopentanone or methylcyclopentanone is effected in any suitable manner. For polymers of a high degree of concentration, it should be advantageous to effect the solution hot, while taking account of the fact that for a high concentration of chloride of polyvinyl, for example 200 grs. per liter, the solution congeals on cooling into a gel. Practically, with chlorides of polyvinyl very strongly polymerized, one should prepare solutions of 150 grs. per liter; solutions of lower polymers could be obtained with much higher concentrations.

Solutions prepared according to the invention may be added to certain liquids not in themselves solvents for chlorides of polyvinyl without any resulting precipitation of the substance dissolved. In this way solutions of 100 grs. per liter may be added to an equal volume of acetate of ethyl, ligroine, acetone or trichlorethylene. The solutions may also be diluted, although to a lesser degree, with benzene, tetrachlorethan or alcohol ethyline or methyline. The new solvents may also be employed in admixture with other solvents, as for example cyclohexanone or methyl-tetrahydrofurane. Such additions may be made in the interest of economy or for convenience in the use of the solutions.

The solutions of polyvinyl in cyclopentanone or methylcyclopentanone, either indifferently, or diluted as described above, can be utilized for all the usual uses such as the manufacture of threads, filaments, films, varnish, veneerings, combinations, etc. according to current techniques.

MAURICE LOUIS AUGUSTE FLUCHAIRE.

Published June 8, 1943

Serial No. 389,409

ALIEN PROPERTY CUSTODIAN

ELECTRONIC MICROSCOPES

Bodo Von Borries, Berlin-Spandau, Germany; vested in the Alien Property Custodian

Application filed April 19, 1941

This invention relates to electronic microscopes provided with electrostatic lenses.

Electronic microscopes employing electrostatic lenses are well known in the art. Such electrostatic lenses have a constant magnification, since the focal length is constant. They therefore present the drawback in that a predetermined magnification depending upon the lenses employed in attained with the aid of electronic microscopes of the above-mentioned character. However, in many cases it is desirable to utilize different magnifications. This has hitherto been possible by means of electronic microscopes provided with electromagnetic lenses.

The object of the present invention is to provide an arrangement, whereby it is possible to vary the magnification with the aid of simple means also in the case of electronic microscopes employing electrostatic lenses. This may be accomplished according to the invention by the fact that at least three electrostatic lenses are provided whose dimensions and magnifications are so chosen that two- or multiple-stage magnifications may be obtained by changing over the voltage connections of the lenses without varying the vacuum. In this manner it is possible when suitably selecting the single magnifications of the lenses to construct an electronic microscope in which the magnifications may be attained in practice with the aid of simple means. The individual magnifications of the lenses are chosen according to the invention preferably in such a manner as to differ from one another. The entire optic system is so set that the maximum magnification capable of being adjusted preferably by inserting all lenses in the circuit, corresponds to the desired magnification, i. e., to the magnification in which the smallest distance between the particles of the object capable of being resolved amounts to 0.3 mm. so that it may be distinctly visible with the naked eye.

In carrying the invention into practice three electrostatic lenses are, for instance, provided which have the constant magnification v_1, v_2 and v_3 respectively. If in this case all three lenses are inserted in the electric circuit the total magnification $Va=v_1.v_2.v_3$ is attained. If only the first and the last lens are inserted the total magnification $Vb=(v_1+v_2).v_3$, whereas if the first and second lense are inserted the total magnification $Vc=(v_2+v_3).v_1$. Three different magnifications may therefore be attained which may be selected at will. It has been found that it is preferable to dimension the arrangement in such a manner that Va=30,000, Vb=12,000, Vc=5,000. To fulfil these requirements, one of the three magnifications v_1, v_2, v_3 must be chosen in the neighborhood of 1,000, which has hitherto not been possible, since only focal lengths of about 4 to 8 mm. could hitherto be attained. With the focal lengths of electrostatic lenses hitherto attainable it is possible to design an arrangement which works satisfactorily by selecting Va=30,000, Vb=5,000 and Vc=900. The last-mentioned conditions may be substantially fulfilled, if $v_1=7$, $v_2=63$, $v_3=70$. In this case the length of the first magnification stage of the electrostatic electronic microscope is only equal to $7.f$, where f is the focal length of the lens of the first stage. This first stage may be combined with the objective to form a unit.

In the accompanying drawing is shown an embodiment of the invention in diagrammatic form. The electrons coming from the electron emitting source **1** pass through the object **2** and then enter the objective consisting of a central electrode **3** and two electrodes **4** and **5** impressed with the same potential. The first intermediate image is obtained in this arrangement on the screen **6**. The electron rays then enter the first projection lens consisting of a central electrode **7** and of two electrodes **8** and **9** impressed with the same potential. The second intermediate image is produced by this lens on the screen **10**. The electron rays then pass through the second projection lens **11**, **12**, **13** and produce the final image on the luminescent screen or on the photographic plate **14**. The connection of the lenses is shown in the drawing for a three-stage magnification.

If only a two-stage magnification is employed, the projecting beam has a diameter of, for instance, 0.7 mm. at the point of the objective **3**, **4**, **5** in the case of an object diaphragm diameter of 0.1 mm. Since the perforation of the central electrode **7** of the second lens may easily have a diameter of 1 mm., this lens when switched out does not affect the path of rays in the case of the two-stage projection. In the case of the two-stage projection the intermediate image is produced at the point **10** which is then magnified by the projection lens **11**, **12**, **13** to a further extent.

In order to pass from the three-stage to the two-stage magnification and vice versa, it is only necessary to connect and disconnect the corresponding lens, for instance, the lens **7**, **8**, **9**. A lens is inserted in the circuit by connecting the central electrode with the cathode or with a voltage source whose potential lies in the neighborhood of the cathode potential. The disconnection

of a lens is effected by connecting the central electrode to ground. These changing over operations are effected by means of the switch 16. When passing from the three-stage magnification to the two-stage magnification, which is effected by disconnecting the lens 7, 8, 9, the object is displaced in the direction of the ray to the point 15. In the electronic microscope constructed according to the invention it is therefore necessary that the object cartridge introduced into the vacuum chamber is so arranged as to permit the same to be displaced in the direction of the ray relatively to the electron ray, which is also necessary when focusing. The arrangement is also so designed as to enable a relative displacement perpendicularly to the direction of the ray in order that the part of the object to be magnified may be adjusted at will.

A considerable number of magnifications suitably chosen throughout the entire range may be obtained if four magnification lenses are employed. The lenses are so arranged within the microscope that they do not cause any limitation of the field of image when disconnected.

In the drawing is shown in full lines the path of ray for the three-stage magnification between the object and the last screen 10 for the intermediate image, whereas the path of ray for the two-stage magnification is shown in dotted lines. In the second magnification stage the edge ray of the final image is shown in full lines, whereas in dotted lines is shown to what extent the final image would be magnified in both cases if the intermediate image screen 10 were not employed for the limitation of the field of image.

BODO v. BORRIES.

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BY A. P. C.

B. VON BORRIES

ELECTRONIC MICROSCOPES

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fm 79335

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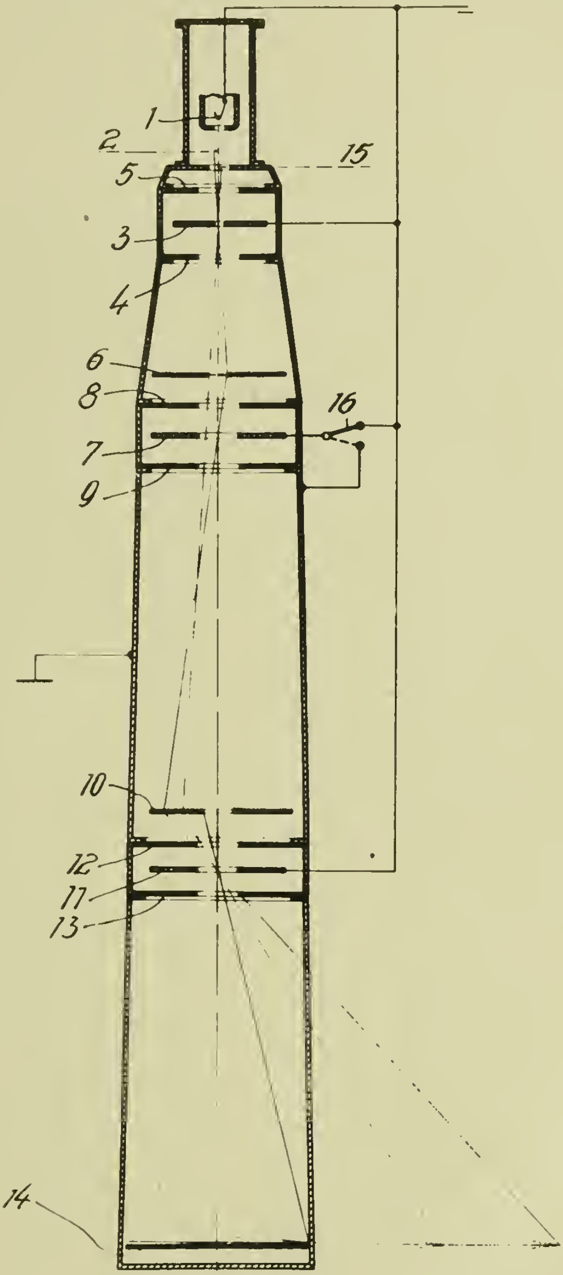


Inventor

Bodo von Borries

By Richardson & Auer

Atty's

Published June 8, 1943

Serial No. 392,580

ALIEN PROPERTY CUSTODIAN

FLUID MIXING APPARATUS

Jean Mercier, Paris, France; vested in the Alien Property Custodian

Application filed May 8, 1941

The present invention relates to apparatus for mixing fluids together.

The chief object of the present invention is to provide an apparatus of this kind which is better adapted to meet the requirements of practice than the fluid mixing apparatus used for the same purpose up to the present time, and in particular to obtain a static apparatus, that is to say an apparatus which effects the mixing at the fluids without having recourse to moving parts.

According to an essential feature of the present invention, the mixing of the fluids is obtained by the action of the fluids themselves, due to the eddies and whirlwinds which are produced in the flow of said fluids, as a consequence of the changes of direction they undergo between the inlet and the outlet of the apparatus, and also of the form of the mixing chamber.

In a more specific manner, the apparatus according to the invention includes a hollow body forming a chamber of rounded section, for instance of the shape of a flat cylinder, with a tangential inlet opening into the periphery of said chamber, and an outlet transverse to the rounded sections of said chamber, for instance extending along the axis of said cylinder.

The fluids are admitted with a high velocity into said chamber through the tangential inlet. They move with a whirlwind motion in the chamber and are compelled to flow out from the chamber in a direction transverse (preferably perpendicular or substantially so) to their initial direction when entering the mixing chamber. Consequently, these fluids are subjected to the action of eddies which thoroughly mix them together.

If the gases or liquids to be mixed together are not already at a high velocity prior to their entering the apparatus, means must be provided for producing this velocity.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic elevational view of a mixing apparatus made according to an embodiment of the invention;

Fig. 2 is a plan view corresponding to Fig. 1;

Fig. 3 is a view, similar to Fig. 1, showing another embodiment of the invention;

Fig. 4 is a plan view corresponding to Fig. 3.

As shown by Fig. 1, the mixing apparatus according to the invention includes a hollow cylindrical casing **1** forming, on the inside thereof, a chamber of any suitable (cylindrical or other) rounded section. This casing is provided with a tangential inlet **2**, to which two fluids are fed through pipes **4** and **5**, respectively. The outlet from this chamber is constituted by a pipe **3** transverse (perpendicular in the embodiment illustrated) to the rounded sections of chamber **1** and to tangential inlet **2**.

The fluids admitted tangentially along the periphery of chamber **1**, move with a whirlwind motion along the inner cylindrical wall of said chamber. As they can flow out only through outlet pipe **3** which extends in a direction at right angles to inlet **2**, eddies are produced, which ensure a thorough mixing of the fluids.

The embodiment of Figs. 3 and 4 is similar to that of Figs. 1 and 2, with the difference that two distinct inlets **6** and **7** are provided for the fluids to be mixed together, both of these inlets opening tangentially into the mixing body.

Furthermore, pump means may be provided, if necessary, as shown at **8**, for imparting a high velocity to the fluids flowing through the apparatus. Of course, if the fluids to be mixed together are already under pressure before entering the apparatus, such pump means are unnecessary.

It will be noted that the form of the sections of the mixing chamber **1** by parallel planes parallel to the direction of the inlet is not limited according to the invention, provided that these sections are rounded so as to permit a high velocity of the fluids gyrating inside the apparatus. Of course, the shape will be chosen (in view of theoretical or practical data) so as to increase the stirring in the chamber. It has been found that high drops of pressure improve the working of the apparatus.

Likewise the shape of the cross sections of mixing chamber **1** by planes at right angles to inlet **2** may be chosen at will. It has been found that a flat shape of this chamber is advantageous.

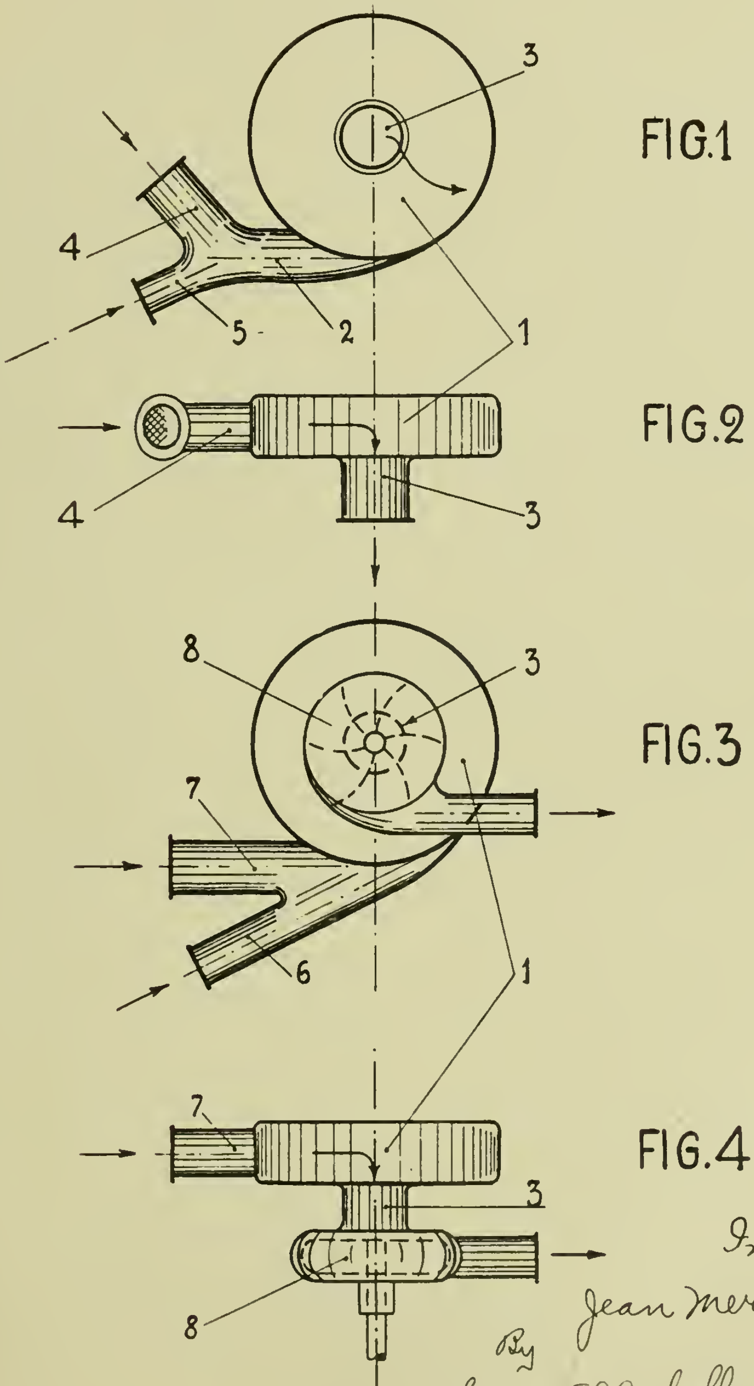
In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

JEAN MERCIER.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

J. MERCIER
FLUID MIXING APPARATUS
Filed March 8 1941

Serial No.
392,580



Inventor
Jean Mercier
By
Singer, Ehlert, Stern & Carlberg
attys

Published June 8, 1943

Serial No. 397,745

ALIEN PROPERTY CUSTODIAN

METHACRYLIC ACID CHLORIDE

Walter Schmidt, Frankfurt am Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed June 12, 1941

The present invention relates to methacrylic acid chloride.

The preparation of methacrylic acid chloride has not yet been described. Since, as it is known, methacrylic acid is easily transformed into polymeric methacrylic acid, especially in the presence of hydrochloric acid, a preparation on an industrial scale by splitting off hydrogen chloride from a chloroisobutyric acid chloride seemed hardly to be possible on account of the hydrogen chloride formed thereby.

Now, I have found that, also in the presence of hydrogen chloride, methacrylic acid chloride may be obtained in a monomeric form by splitting off hydrogen chloride from beta-chloro-iso-butyric acid chloride. Whereas the preparation of acrylic acid chloride from chloropropionic acid chloride is advantageously carried out in the gaseous phase, it has been found that the splitting off of hydrogen chloride from beta-chloro-iso-butyric acid chloride with formation of methacrylic acid chloride is arrived at already in the liquid state so that the higher temperatures of the gaseous phase which give rise to polymerization losses are avoided. The splitting off of hydrogen chloride may be accelerated and facilitated by working in the presence of catalyzers splitting off acid. All known catalyzers splitting off hydrogen chloride are, however, not suitable; for instance, anhydrous barium chloride and magnesium chloride are hardly effective whereas others, such as iron oxide and zinc oxide, partly effect resinifications. When selecting the catalyzers, it must be borne in mind to combine a rapid reaction with as small as possible a secondary effect on the reaction products. Small additions of activated carbon, of a $MgO.MgCl_2$-catalyzer and of copper phosphate have proved to be especially suitable. When using other catalyzers, for instance phosphorus pentoxide, which enable the splitting off of hydrogen chloride already at low temperature but show secondary effects at higher temperatures, it is suitable to avoid higher temperatures by separating the resultant methacrylic acid chloride under reduced pressure. It is in general advisable to quickly carry away the methacrylic acid chloride which has been formed in order to avoid losses in polymerization, for instance, by using heated distilling tubes which, although they condense again and lead back the unchanged beta-chloro-isobutyric acid chloride, do not precipitate the methacrylic acid chloride which boils at essentially lower temperatures but lead it away rapidly. Since the splitting off of hydrogen chloride from beta-chloro-isobutyric acid chloride in the liquid phase gradually slows down, it is advantageous to interrupt it before the reaction is finished and to recover, advantageously by distillation under reduced pressure, that part which has not been reacted upon and to use it again. By a suitable apparatus the process may be carried out continuously.

The beta-chloro-isobutyric acid chloride used as parent material may be prepared by chlorination of alpha-methyl-propionyl-chloride. The process described allows of obtaining in a technically simple manner the methacrylic acid chloride hitherto not known but required since a long time as intermediate product particularly for the production of plastics.

Methacrylic acid chloride is a liquid clear as water which boils under a pressure of 50 mm at 42° C.

The following examples serve to illustrate the invention but they are not intended to limit it thereto; the parts are by weight:

(1) 250 parts of beta-chloro-isobutyric acid chloride are heated in a round-bottomed flask which is connected with a distilling tube heated by means of steam. The temperature is regulated so that it does not exceed 100° C. in the middle of the tube and 95° C. at the place where the distillate passes over. The methacrylic acid chloride formed is condensed by a cooler and separated from the hydrogen chloride. Since after a heating of 8½ hours the evolution of hydrogen chloride slows down, the operation is stopped at this point. The distillate amounts to 74.5 parts and, when rectified under reduced pressure, passes over almost entirely at 42° C. under a pressure of 50 mm. The unchanged beta-chloro-isobutyric acid chloride—i. e. 132 parts—is distilled under a pressure of 50 mm so that 92% are recovered which may be used for a new batch.

(2) It is worked as indicated in example 1 but with addition of 2.5 parts of activated carbon (phosphoric acid peat charcoal). The evolution of hydrogen chloride sets in more vividly and already at lower temperatures than without the addition of the catalyzer. After 6 hours, 113.5 parts of methacrylic acid chloride have distilled and the evolution of hydrogen chloride has slowed down. The residue amounts to 85 parts, of which 75 parts are recovered by distillation under reduced pressure as unchanged beta-chloro isobutyric acid chloride.

(3) Crystallized magnesium chloride,

$$MgCl_2.6H_2O$$

is for the most part dehydrated by heating and 2.5 parts of the resultant chloride containing magnesium oxide as used as catalyzer in a batch as described in example 1. In the course of 6 hours, 117 grams of distillate are obtained and 74 parts remain as residue. Anhydrous molten magnesium chloride works essentially slower than the chloride containing magnesium oxide,

whereas magnesium chloride alone gives rise to losses by resinification of part of the residue.

(4) It is proceeded as indicated in example 1 but with addition of 1% of copper phosphate. After 9 hours' heating, 96 parts of methacrylic acid chloride are obtained as well as 90.5 parts of residue from which 80% of the parent material may be recovered.

(5) Phosphorus pentoxide as catalyzer gives rise to an early evolution of hydrogen chloride but also to a carbonization of part of the residue. The disadvantageous secondary effect of the otherwise active catalyzer can be avoided for the most part by performing the splitting off of the hydrogen chloride under reduced pressure. Under a pressure of 200 mm 117.5 parts of the distillate pass over at a temperature of 60° C.–70° C. The residue, 90.5 parts, is carbonized only to a small extent so that 85% thereof may be recovered and used again as parent material. Since the crude methacrylic acid chloride contains still a small quantity of carried-over beta-chloro-isobutyric acid chloride, it is advantageously subjected to a rectification under reduced pressure.

WALTER SCHMIDT.

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ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR PLACING IN SUSPENSION IN AIR AN ULTRA-DISPERSED FLUID OR OTHER DRY PRODUCTS IN POWDER FORM

Emile Piquerez, Saint-Cloud, France; vested in the Alien Property Custodian

Application filed June 13, 1941

The creation of an extremely fine film, from a fluid, is obtainable by pressure and by flowing through a passageway having a cross section equivalent in thickness to the fineness of the film. Such a realization necessitates high pressures and consequently involves fluid-tight devices which, in practice, are difficult to construct.

The present invention relates to a process for placing in colloidal suspension a fluid—or products in powder form—and to the apparatus by means of which an extremely fine film—or a vapour—can be created without it being necessary to use complicated fluid-tight devices of limited duration.

In accordance with the invention, the film—or the vapour—is created by the use of centrifugal force which by the adherent sticking of the fluid used (or of the powder) on the rotary member, converts said fluid—or said powder—into a film—or into a vapour; the film or the vapour following a path having a suitable curve so as to issue tangentially (horizontal sheets).

The ultra-dispersion produced, the particles of which are subjected to "Brownian" motion, depends on the superficial exciting effect of centrifugal force and the thinning of the film in formation on the rotary member produces, during the rotation, the desired superficial increase of the film.

The exciting can be increased by circulation of air or other gas and by heat exchange.

The apparatus provided for the production of said film is essentially characterised by the fact that it comprises a rotary receiver arranged in such a manner that the fluid—or the powder—to be treated falls therein by gravity or is projected therein.

In said apparatus the evaporation of the fluid resulting from centrifugal force due to the action of the rotary receiver is advantageously excited by means of any suitably directed current, the profile of the rotary receiver and the walls of the enclosure in which said rotary receiver is contained being taken into consideration.

The non reduced droplets or particles strike against a fixed surface of the apparatus and are recovered to be utilised over again.

The fluid—or the powder—to be treated, can fall from a reservoir on the rotating receiver, either approximately at the centre of the latter so as to start from a practically null speed and to acquire a uniformly accelerated peripheral speed; or, on any practically utilisable generatrix of said receiver, in which case the impact produced can be used without moreover modifying the general operation of the apparatus.

The placing in suspension in the atmosphere of various products necessitates, in accordance with this process and with the apparatus allowing it to be carried into practice, only very small quantities of said products, comparatively to the known atomization process. Furthermore, the extremely divided products have a much greater activity than when they are in vapour form.

The scope of application of the invention is very wide since in practice it can extend from a private room or a hospital ward for obtaining in such enclosures air which is chemically and bacteriologically pure, up to the creation of smoke allowing for instance to camouflage warships.

This scope includes among others the creation of widespread protection zones against attacks by asphyxiating gases or bacteriological war, the same results being obtained on a smaller scale in private or public shelters.

The invention will moreover be better understood by referring to the accompanying drawing by way of example and in which:

Fig. 1 illustrates in vertical axial section an apparatus according to the invention.

Fig. 2 is a view similar to Fig. 1 of a first constructional modification.

Fig. 3 is a view similar to Fig. 1 of a second constructional modification.

Fig. 4 is a diagrammatic view of a device of high output.

Fig. 5 shows a rotary receiver combined with a complementary blowing device.

Fig. 6 shows a rotary receiver with stages.

In the embodiment of the apparatus according to Fig. 1, a base **1** is shaped so as to carry the body **2** of the apparatus and to support a propeller **3** the driving shaft **4** of which is axially and upwardly extended within the body **2** of the apparatus.

On the projecting end of the driving shaft **4** is secured, by any suitable means, the receiver **5** which, in this case, has a conical shape.

A partition **6** also secured on the base **1** is so shaped as to create, below the disc **5**, an annular enclosure **7** for the recovery of the non reduced fluid. A cock **8** is arranged at the lower part of the enclosure **7** for extracting, in view of its re-utilisation, the non reduced fluid.

The annular space **9** left available between the disc **5** and the partition **6** is used for housing the blowing device **10**.

According to the form of construction chosen,

the vanes of the blowing device 10 are directly secured on the back of the working disc 5.

At the upper part of the body 2 of the apparatus is secured a ring 11 reinforcing said body when the latter is made of sheet metal and comprising an internal screw thread 12 intended to receive a second screw threaded ring 13 carrying a reservoir 14 of cylindrical shape containing the liquid 15 to be treated.

The bottom of the reservoir 14 is of conical shape, at 16, terminating in a portion 17 of reduced diameter carrying a nozzle 18 having a calibrated hole 19 for the passage of the liquid 15 issuing from the reservoir 14.

The screw threaded ring 13 is so constructed as to provide, at the centre, a vertical hub 20 internally threaded for receiving an operating hand-wheel 21 comprising a screw threaded sleeve 22. The hand-wheel 21 carries a rod 23 the lower end of which is provided with a conical closing valve 24. The fluid-tightness of the conical valve on the cone 16 of the reservoir 14 is reinforced by a washer made of suitable material 25 secured on said valve 24.

Above the recovery enclosure 7 is arranged a reducing enclosure 26 limited by the disc 5, the inner surface of the body 2 approximately located at the level of the disc 5 and a tubular conical partition 27 secured within the body 2; the apex of the truncated cone 27 being directed towards the lower part of the apparatus.

Directly above the upper level of the cone 27, openings 28 are perforated in the body 2 and extend practically up to the edge of the annular reinforcing ring 11. Said openings through which the ultra-dispersions produced in the form of a film can issue from the apparatus are provided with suitable cloth filters 29 intended to protect the internal mechanism from external agents.

The screw threaded ring 13 is provided with wings 30 facilitating the screwing of the reservoir 14 for the liquid to be treated, in the apparatus.

A cover 31 is placed on the ring 13 so as to ensure a sufficient fluid-tightness so that no leakage to the atmosphere is possible.

The disc 5 has series of perforations 32 for the passage of the air delivered by the blowing device 10.

The blowing device 10 creates, within the enclosures 7 and 26, a pressure which, during the operation of the apparatus, that is to say when the closing valve 24 is open, acts in antagonism to the emptying of the reservoir 14; it is therefore necessary that the latter should comprise a means for balancing the pressures since the reservoir is closed to the atmosphere by the cover 31.

This balancing is obtained by arranging within the reservoir 14 a pipe 33 which, leading from the bottom of the reservoir, rises up to a level higher than that of the liquid, thus putting the empty space located above the liquid 15 in a state of suitable equilibrium allowing the emptying of the liquid to be treated through the calibrated orifice 19.

According to this embodiment the centre of the calibrated orifice 19 through which the liquid issues from the reservoir to fall on the disc 5 is located on the axis of the apparatus which is mingled with the axis of rotation of the disc 5.

The disc 5 presents, at the centre, a tubular housing 34 intended to receive a cylindrical block 35 on the upper face of which is milled a cup 36 for the reception of the liquid to be treated falling from the reservoir 14.

For using the apparatus described—the reservoir 14 being previously filled with liquid to be treated up to a level which does not reach to the top of pipe 33—the cover 31 is removed and the valve 24 is slightly lifted from its seat, located on the conical part 16 of reservoir 14, by causing the hand-wheel 21 to rotate in the required direction, the propeller 3 is simultaneously set in action, and, through its driving shaft 4, rotatively drives the working disc 5.

The liquid to be treated which, after having passed about the valve 24 issues from the reservoir 14, through the calibrated orifice 19, falls in the cup 36 of the rotating disc 5, in a zone from which the liquid starts at a practically null speed and acquires on the disc a uniformly accelerated speed. The extremely thin film which forms follows a path according to a curve of the second degree to escape tangentially.

As the ultra-dispersions must be subjected to "Brownian" motion and must depend on the superficial exciting, their thinning has already allowed an increase of surface.

The blowing device 10 being synchronised with the rotation of disc 5, the air stream sent by said device allows of obtaining an increase of the exciting by circulation and by heat exchange.

The ultra-dispersions are then in the enclosure 26 and escape from the apparatus through the openings 28, after having passed between the inverted truncated cone 27 and the reservoir 14.

The non reduced liquid strikes, in the form of droplets, the inside of the body 2 above the level of disc 27 and adheres on said surface of the body 2 from which it falls into the recovery enclosure 7.

From said recovery enclosure 7 the non reduced liquid can be taken up again through the cock 8 to be subsequently placed again in the reservoir 14.

In the embodiment illustrated in Fig. 2, the receiver 5 has the shape of a tumbler the bottom 40 of which has, in its centre, a cavity 41 equivalent to the milled cup 36 of Fig. 1.

The tumbler 5 extends below the bottom 4 to be secured at 49 on the driving shaft 4 of the propeller 3 which, as in Fig. 1, is supported by the base 1.

The blowing device 10 which is carried by the lower part of tumbler 5 is housed in the cylindrical part 42 of a sheet metal hoop 43 of frustum shape which diverges downwardly from the cylindrical part.

This hoop 43 arranged within the body 2 allows of obtaining the recovery enclosure 7, as in Fig 1.

The part of the tumbler 5 which is above the level of the blowing device 10 has outlet openings 44 for the ultra-dispersions, a fine mesh system being arranged inside said tumbler.

A fluid-tight inspection hole 45 mounted at a suitable level on the body 2 allows the inside of the apparatus to be seen.

The propeller 3 being protected by a casing 46, circular openings 47 and 48 are provided, respectively in the base 1 and in the upper central part of the casing 46, so that the air draught from the blowing device 10 passes around the propeller 3 for ensuring the cooling thereof.

All the other parts of the apparatus fulfill the same functions as in the embodiment according to Fig. 1, the ultra-dispersions being compelled to follow a slightly different path to issue from

the apparatus; the outlet finally taking place through openings 47^a protected by networks of meshes 48^a.

The operation takes place in an absolutely identical manner as that described with reference to the apparatus illustrated in Fig. 1.

In the embodiment illustrated in Fig. 3, the receiver **5** has the shape of a basin. The product to be treated is admitted through a conduit **50** on which is provided a cock, not shown, for adjusting the outflow.

At a certain distance above the receiver **5** is arranged a conical cap **52** the apex of which is directed towards the receiver and which is supported by the arms **56** of a ring **54** secured on the conduit **50**.

The operation according to this embodiment is different from that described with reference to Figs. 1 and 2. The difference results from the fact that the film which escapes tangentially from the receiver **5** strikes against the perfectly polished inner surface of a ring **53** which is supported by means of arms **57** secured, on the other hand, within the body **2** of the apparatus.

This fixed ring **53** completes, with a gap, the profile of the receiver **5**; an annular space **55** constituting the gap.

The horizontal sheet therefore leaving the rotary receiver **5** tangentially, strikes, as already indicated, against the polished internal surface of a fixed ring **53**; whereas the pressure of the air draught arising from the blower **10** through the gap **55** completes the exciting and tends to direct the ultra-dispersions against the opposite surface of the conical cap **52** which acts as a screen facilitating the evacuation of the ultra-dispersions, to the exterior. The nonreduced liquid passes over the cap **52** which, constituting a funnel, brings it back to the place of utilisation.

The more the surface of the fixed ring **53** is polished, the better is the result obtained owing to the fact that the risks of adherence are avoided.

In Fig. 4 has been shown, more or less diagrammatically, the essential part of an apparatus which is particularly suitable for the production of ultra-dispersions—smoke—in such quantities that they allow the camouflage, either of warships, or of land positions.

The large receiver **5** rotatively driven by the shaft **4** of a sufficiently powerful propeller **3** has a shape resembling that of a flat plate and the thickness of which relatively great at the centre gradually thins towards the slightly turned up edges of the periphery so as to reduce as much as possible the peripheral weight; whereas the material to be treated—liquid solution or pulverulent product—is emptied on said receiver through an orifice calibrated or not at a rate, litres per hour, relatively important.

In Fig. 5 a rotary receiver **5** has been shown of the type of that illustrated in Fig. 3. According to said figure, at a certain distance above the receiver **5** is arranged a disc **60** having approximately the same profile so that a real pump **61** is created resulting from the action of the blowing device illustrated in Figs. 1 to 3. The function of said pump is to complete the formation of the ultra-dispersions and to facilitate their evacuation towards the atmosphere, result which can be combined or not with the result described relatively to the polished surface of ring **53**.

In Fig. 6 has been shown a rotary receiver according to which the ultra-dispersions are created in a stepped manner.

At a certain radius more or less remote from the centre of the rotary receiver **5** is arranged a first flared ring **65** of relatively small height which constitutes a first stage of work. The material to be treated falling at the centre of the receiver **5** begins to thin and the film in formation escapes tangentially from the ring **65**. The thinning accentuates up to a second stage **66** of slightly greater height and so on according to the number of stages provided and the film finally leaves the rotary plate **5** as in the preceding examples.

In certain cases this arrangement allows of increasing the limit of resilient distortion of the film in formation.

It is to be understood that the embodiments illustrated have been described only by way of explanatory examples and not in a limiting sense, and that all modifications can be made therein without changing the nature of the invention. Thus, for instance, the reducing receiver can have any shape other than those shown, for instance the shape might extend from the flat shape to the various concave or convex shapes. The working stages, instead of being secured in position might be constituted by concentric undulations of the receiver itself. The blower might be of any known type and arranged in any other place in the apparatus and even outside the latter. The air draught might also be replaced by any injection under pressure of gas or of vapours. The vanes of the blowing device instead of being secured on the receiver, might be constituted by alveoles made in the receiver itself. The dropping zone for the product to be reduced, on the receiver might be located on a radius more or less remote from the axis of rotation.

EMILE PIQUEREZ.

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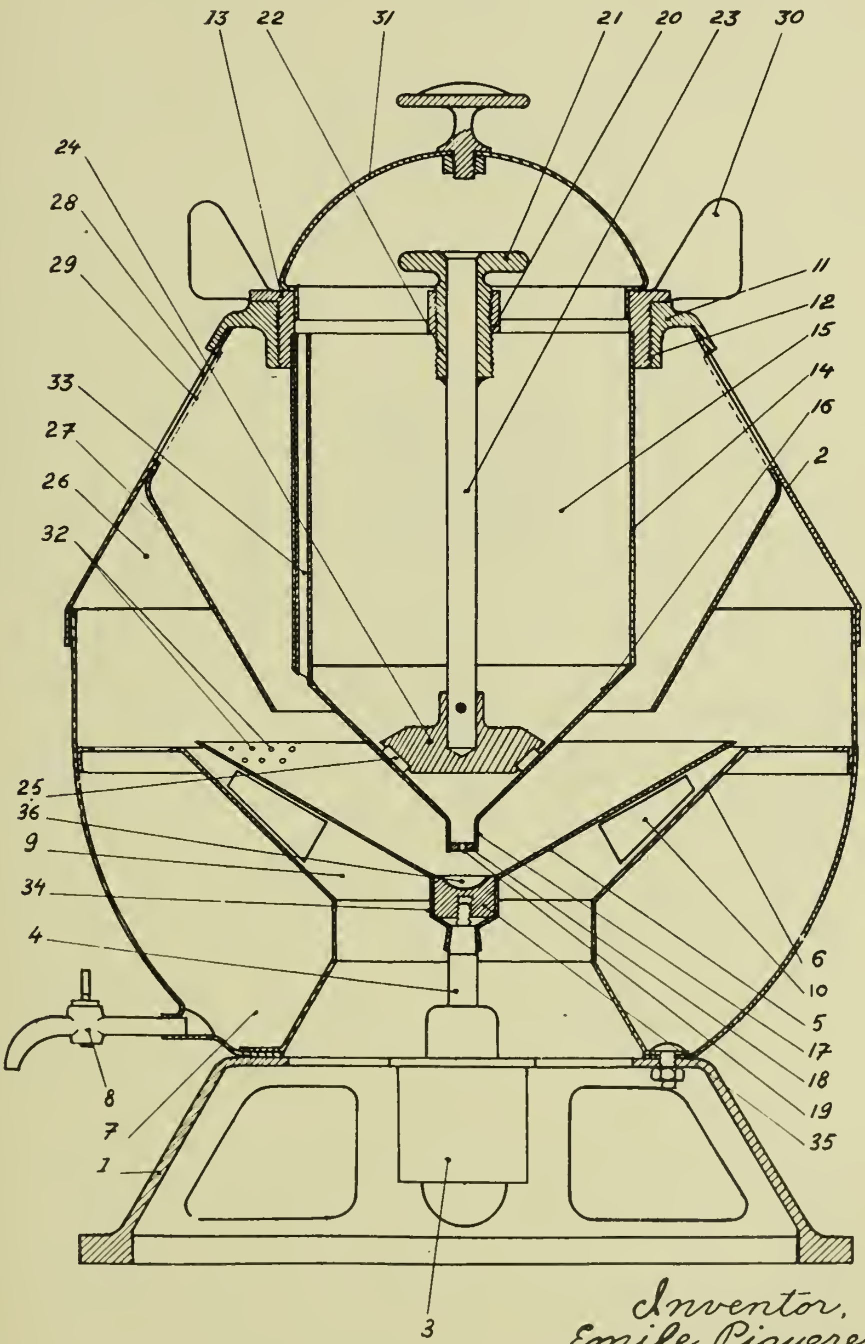
PROCESS AND APPARATUS FOR PLACING IN SUSPENSION IN AIR AN ULTRA-DISPERSED FLUID OR OTHER DRY PRODUCTS IN POWDER FORM

Filed June 13, 1941

Serial No. 397,993

4 Sheets-Sheet 1

FIG. 1



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JUNE 8, 1943.

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PROCESS AND APPARATUS FOR PLACING IN SUSPENSION IN AIR AN ULTRA-DISPERSED FLUID OR OTHER DRY PRODUCTS IN POWDER FORM

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4 Sheets-Sheet 2

FIG. 2

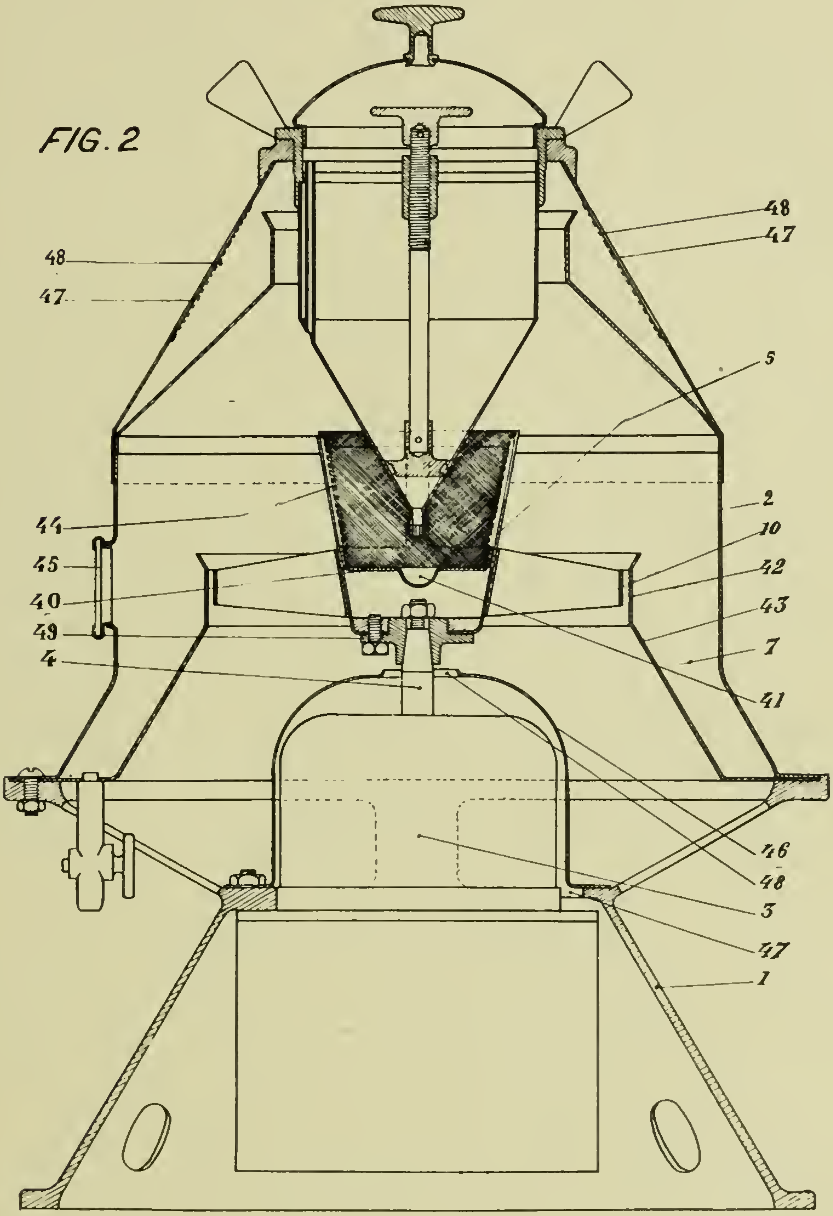

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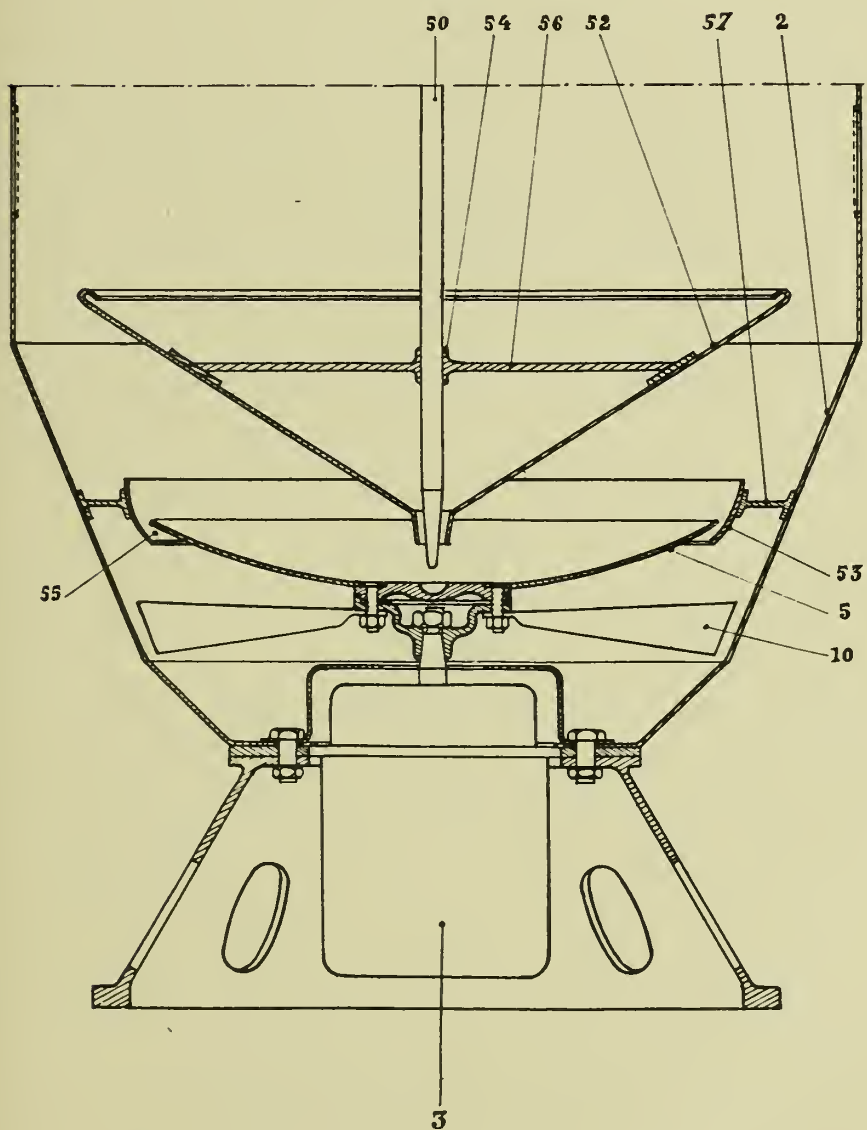
FIG. 3



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4 Sheets-Sheet 4

FIG.4

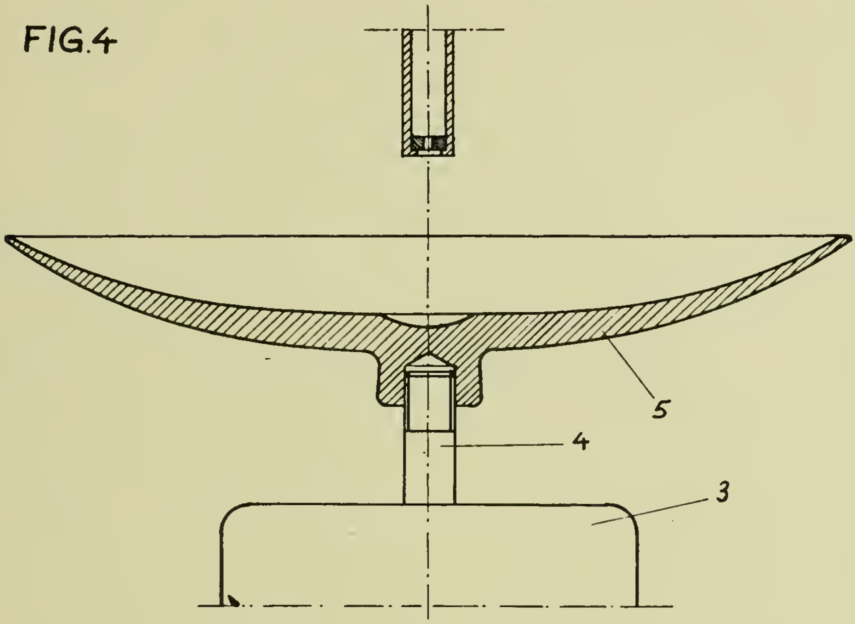


FIG.5

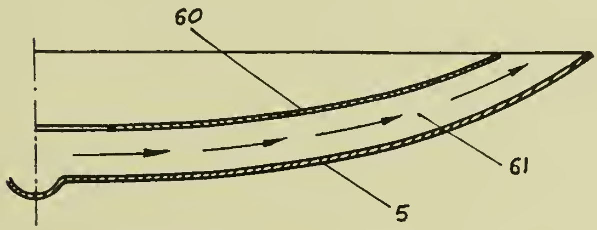
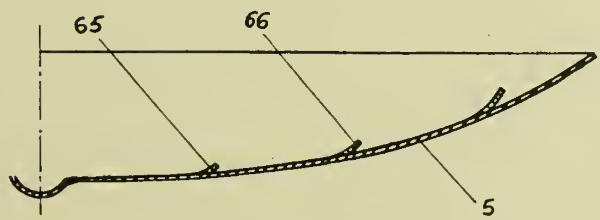


FIG.6



Inventor,
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ALIEN PROPERTY CUSTODIAN

PISTON

Alfred Scheibe, Dessau-Ziebigk, Germany; vested in the Alien Property Custodian

Application filed September 16, 1941

This invention is directed to a piston for internal combustion engines, and in particular to a novel elastic heat transmitting and sealing fin construction for a piston.

This application is a continuation-in-part of my application for Piston, S. N. 290,458, filed August 16, 1939.

Pistons for internal combustion engines must fit the cylinder walls very closely in order to conserve power by preventing gas escapage from the combustion chamber, to prevent the passage of lubricating oil into the combustion chamber, and to ensure silent and low friction operation of the piston within the cylinder. High speed engines develop considerable heat and pressure upon the piston, which cause thermal expansion and distortion of the piston so that the close fit of the piston with the cylinder wall is lost, and a loss of power results. In aggravated cases injury to the piston and cylinder can occur by reason of increased friction resulting from piston expansion, which may cause the piston to seize or stick in the cylinder.

In order to prevent harmful results, known pistons are formed with two or more vertically extending slots cut entirely through the skirt of the piston to create a plurality of segments depending below the piston head. Thermal expansion of the piston is taken care of by the elasticity of these segments. However, as the piston head and the piston skirt are subjected to different thermal expansions, and to different mechanical pressures, this construction does not give a satisfactory balance between the piston head and skirt insofar as the elasticity of the skirt required to make a close fit with the cylinder wall, and the expansion necessary under heating, is concerned, and trouble in the use of the piston results.

Furthermore, in order to prevent the piston from tipping in the cylinder, prior art pistons are made with lengths greater than their diameters, and these proportions accordingly create pistons of rather large size, weight and frictional contact with the cylinder walls.

An object of this invention is to produce a piston in which the piston head and skirt are maintained in constant thermal and mechanical balance.

Another object of the invention is to construct a piston having elastic means determined with respect to the thermal expansion of the piston.

Another object of the invention is to produce a piston in which the skirt not only dissipates its own heat, but also heat developed in the piston head.

Another object of the invention is to produce a piston having a skirt which has very little frictional contact with the cylinder wall.

Another object of the invention is to produce a piston having elastic means on the skirt thereof which takes care of thermal expansion and mechanical distortion of the piston as well as provides means to prevent lubricating oil from entering into the combustion chamber of the cylinder.

Another object of the invention is to produce a piston having a length substantially equal to or less than the diameter of the piston, and which satisfactorily conducts heat to the cylinder walls while maintaining a tight oil seal and low frictional contact there against.

Generally these objects of the invention are obtained by cutting into substantially the entire surface of the skirt of the piston a plurality of circumferential grooves, or a single or multiple threaded groove. The grooves are inclined inwardly toward the piston head, and form conically surfaced or bell-shaped fins from the material of the piston left therebetween. Usually the skirt is integral with the piston head and therefore heat conducted from the piston head is dissipated through the fins, which thus act in the nature of cooling fins. The ends of the fins bear upon the cylinder wall with a less bearing area, and consequently less friction, than an uncut skirt. The relative elasticity of the fins allows for expansion and distortion of the piston, while maintaining a tight fit between the piston and the cylinder wall. Furthermore, the fins in combination with the grooves take the place of the conventional piston rings.

As substantially the entire peripheral surface of the piston is tightly and resiliently supported against the cylinder wall, the piston can be given a length equal or less than its diameter without the danger of its tipping in the cylinder.

The means by which the objects of the invention are obtained are fully described in combination with the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of a cylinder with a piston constructed according to this invention therein;

Fig. 2 is a cross-sectional view of a portion of a piston showing the formation of fins between circumferentially cut grooves in the piston;

Fig. 3 is a similar view of Fig. 2 turned 90°;

Fig. 4 is a view similar to Fig. 2, but showing a modified form in which the fin forming grooves are limited to the piston skirt; and

Fig. 5 is a side view of a part of a piston showing the grooves cut in the form of threads.

In Fig. 1 piston **2** is shown in a cylinder **3**. Because of the novel construction of piston **2**, this piston has a length **l** substantially equal to or less than its diameter *d*, without danger of the piston tipping in the cylinder. The construction of the piston which makes this possible is more fully shown in Figs. 2 to 5, inclusive.

Piston **2** in Figs. 2 and 3 is composed of a piston head **4**, an integral depending skirt **6**, and internal reinforcing flanges **8**, through which extends bore **10** which is adapted to receive the conventional wrist pin.

Annular grooves **12** are cut in the outer periphery of head **4** and skirt **6**. As shown, these grooves cover substantially the entire peripheral surface of the piston and are inclined upwardly with respect to the vertical axis of the piston. Between adjacent grooves **12** are formed fins **14** which, because of the inclination thereof, have conical upper and lower surfaces. Ends **16** of fins **14** are the original piston surface and are adapted to bear upon the cylinder wall.

Fins **14** are sufficiently thin so that they are relatively elastic as compared with the remainder of the piston. Substantially the entire peripheral surface thus comprises a uniformly elastic portion integrally attached to the main body of the piston. Piston **2**, of course, expands radially upon being heated. As the fins are inclined with respect to the vertical axis of the piston, and form an acute angle therewith, they will bend when pressed against the cylinder wall and thus obtain the full effect of their elasticity. The possibility of the piston freezing or jamming against the cylinder wall is thus considerably lessened. Heat generated in the piston head is conducted to the fins and is dissipated therefrom by the ends **16** which bear against the cylinder wall. The size of the fins is thus determined by the degree of elasticity and the radiating surface required in the operation of any particular engine it being noted that because the entire surface of the piston is covered by fins, a large surface area of the piston constitutes a heating conducting surface for transmitting heat to the cylinder wall. As ends **16** fit tightly against the cylinder wall when expanded under the heat of working conditions, the fins and grooves are sufficient to function as a packing and the conventional piston rings can be omitted from the piston. Moreover, ends **16** represent a substantial reduction in the bearing area of piston **2** against a cylinder wall, and thus the piston slides with less friction against the wall. As the piston is fitted when cold into the cylinder, enough play is left so that the fins when expanded under heat will bear with proper sealing force against the cylinder wall.

If, however, under special circumstances, it is desirable to use piston rings, they can be provided at any part of the piston body without interfering with the advantageous construction of this invention. For example, in Fig. 4, grooves **18** are formed in the head **4** of piston **2**, for the reception of the conventional fire rings or piston rings. In the skirt **6** of piston **2**, fins **14** are formed as shown in Fig. 2.

In Fig. 5, a modified manner of forming the fins is shown. Grooves **22** are cut around the outside surface of the piston in the form of a single or a multiple thread. Spiral fins **24** are thus formed between adjacent grooves.

The upper ends of the grooves are closed at **26** in order to seal them from the combustion chamber. As in Fig. 2, grooves **22** are inclined with respect to the vertical axis of the cylinder, and fins **24** function similar to fins **14**.

The invention has advantages over prior known pistons in that the novel fins allow the pistons to expand through their elasticity while at the same time maintaining a tight sealing fit with the cylinder wall and dissipating heat conducted from the piston head. Because the fins conduct considerable heat to the cylinder wall, and at the same time keep the piston from tipping in the cylinder, the piston can have a length substantially equal to or less than the diameter of this piston. This is very advantageous in engine construction, particularly in aircraft engines, as the pistons can be made lighter and operate with less friction than ordinary pistons, and the engine can be made more compact.

ALFRED SCHEIBE.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

A. SCHEIBE

PISTON

Filed Sept. 16, 1941

Serial No.
411,083

Fig. 1.

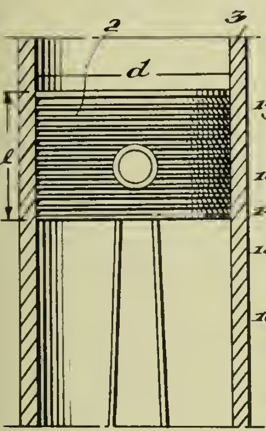


Fig. 2.

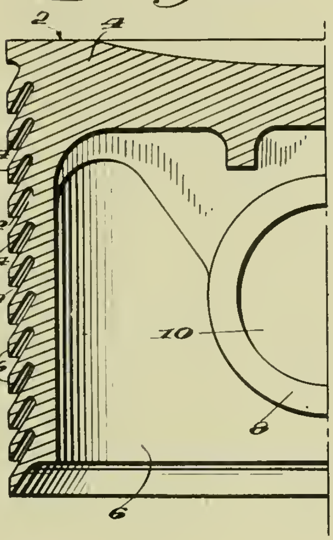


Fig. 3.

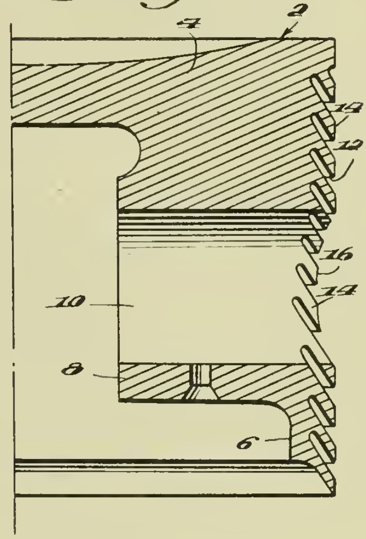


Fig. 4.

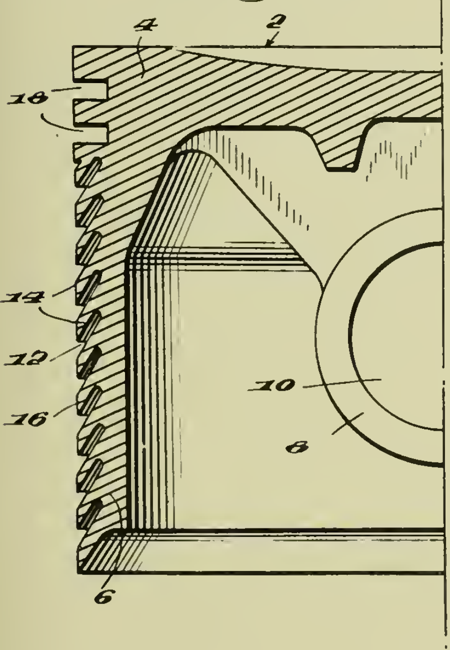
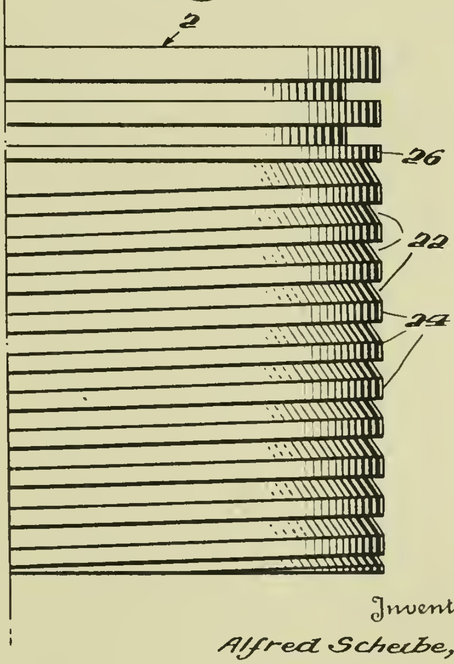


Fig. 5.



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Alfred Scheibe,

By Bailey, Stephens & Huettig
Attorney

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ALIEN PROPERTY CUSTODIAN

PARACHUTE EQUIPPED AIRPLANES

Imre Kertész, Balatonboglar, Hungary; vested in the Alien Property Custodian

Application filed September 18, 1941

Most accidents suffered by aircraft are due a stoppage, for some reason or other, of the engine. In this case the air propeller ceases to drive air below the wings, and in consequence thereof the airplane loses its stability. In view of the fact that it is in front, where the engines are situated, that the greatest load is placed, the airplane will topple into a vertical position, with engines downwards, and will drop with a uniformly accelerated speed. In view of the fact that in this direction the resistance offered by the air to the motion of the airplane is small, the airplane will drop with an acceleration nearly as great as if it were dropping in a vacuum, and therefore the passengers will not have sufficient time to save their lives by jumping out with the aid of parachutes.

The invention relates to a parachute-equipped airplane the arrangement being such that as the airplane topples into the vertical position either the parachute will open automatically, or by means controlling the opening of the parachute operated by the pilot.

The invention consists substantially in that a folded up parachute covered by a detachable sheath is provided along the trunk of the airplane which parachute, as soon as the airplane assumes the vertical position, will become deflected and, following this, will drop from the frame.

The surface of resistance, becoming increased by the surface of the opened parachute will substantially reduce the acceleration of the fall and will thus enable the passengers to jump off with the aid of parachutes. Moreover, as the airplane itself also will reach the ground at a much lower speed, the airplane itself also will suffer substantially less damage than would be suffered by an airplane dropping by free fall.

Whilst an airplane having a weight of 2000 kg will, when dropping from a height of 1000 metres, reach the ground within a time of 15 seconds and at a speed of 134 metres per second, an airplane having the same weight, but equipped with a parachute of 10 metres diameter, will reach the ground in 4½ minutes, and at a speed of only 7.29 metres per second.

The accompanying drawing illustrates an embodiment shown by way of example, of the invention:

Fig. 1 is a side elevation—partly in section—of the parachute-equipped airplane, the parachute being shown in the closed and in the partly opened condition.

Fig. 2 is a front elevation of the airplane according to Fig. 1, during its fall.

Fig. 3 is a vertical cross-section taken along plane A—B of Fig. 1.

A parachute 1 is mounted on the trunk 18 of the airplane. A plurality of arcuate sheets 2, situated alongside each other in the longitudinal direction, and forming in their totality the surface of a small-angled truncated cone, form a sheath around the trunk 18 of the airplane. These sheets are fixed on the trunk 18 in such a manner that their front edges are held down by a ring 4 reinforced by the arms 14, whilst the rear edges 3 of the sheets project below the edge 5 of the airplane trunk, owing to which arrangement the sheets 2 are fixed in their respective positions. Below the sheets 2 there are arranged, between the longitudinals 6 of the airplane (Fig. 3), a number of parachute-opening ribs 7, e. g. four such ribs). The material of the parachute 1 is placed below the sheets 2 on the longitudinals 6 and on the ribs 7. The ends, projecting below the edge 5 of the trunk, of the ribs 7 are connected with the frame of the airplane by means of joints 19. It is at the same place that the upper edge of the parachute 1 also is fixed to the frame.

In the interior of the airplane trunk a cylinder 8 is provided, into which compressed air is made to flow from a container, not shown, through pipe 9 and cock 10. The cock 10 is opened by the arm 11 which can be adjusted by the pilot by means of an operating rod. In the case of another arrangement, the arm 11 carries a weight 20 which turns the arm always into the vertical direction. Accordingly, if the airplane gets into the vertical position, the arm 11 will be deflected into the position shown in dotted lines on Fig. 1 and will thus open the cock 10. The cylinder 8 contains two pistons. The piston 12 stands in connection, through the piston-rod 13 and the reinforcing arms 14; with the ring 4, whereas the piston 15 is connected through the piston-rod 16 with the rib-lifting rods 17 connected articulately with the end of the said piston-rod, the said rib-lifting rods being fixed articulately to the ribs 7. The holding cords 21 sewn to the lower edge of the parachute are tied below the ring 4 to the inner frame of the airplane.

The parachute-equipped airplane operates in the following manner:

At the moment when the airplane topples into the vertical position and begins to drop, the arm 11 is either brought into the vertical position by the pilot, or turns into this position under the action of a weight, and opens the cock 10. The

compressed air flowing into the cylinder 8 drives the pistons 12 and 15 into the positions shown in dotted lines. The piston 12 displaces, by means of the rod 13, the ring 4, whilst the piston 15 lifts, through the rod 16, the ribs 7 (shown in dotted lines in Fig. 1). The sheets 2, having become released from the clamping effect of the ring 9, will become detached and drop down. In the meantime the airplane begins to sink and the air current of growing intensity will lift the parachute placed on the ribs 7 (Fig. 2); the fall will, in consequence of the large surface of the parachute, take place at a slow rate, so that the pilot and the passengers will have sufficient time for jumping out with the aid of parachutes.

IMRE KERTÉSZ.

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PARACHUTE EQUIPPED AIRPLANES
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Fig. 1

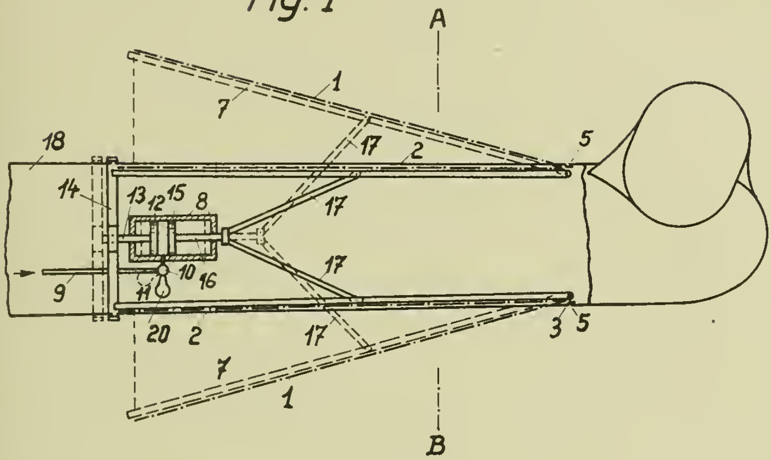


Fig. 2

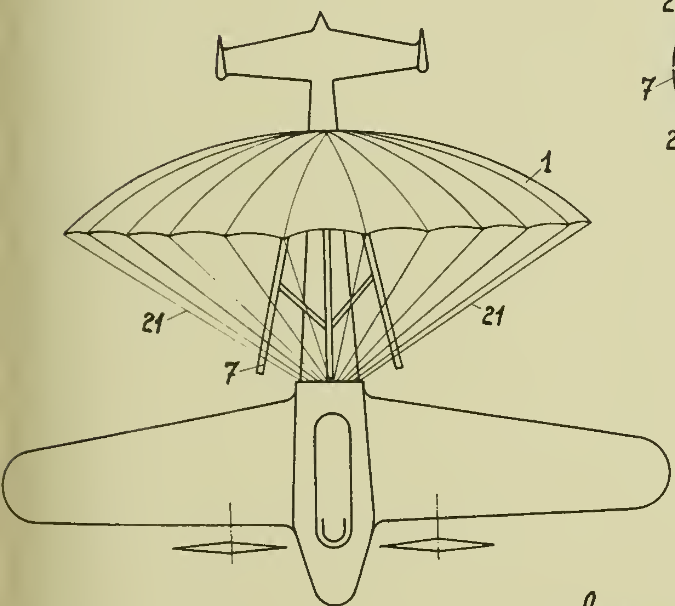
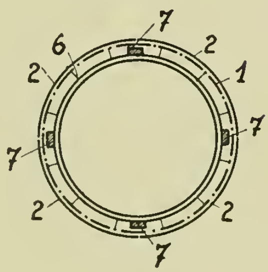


Fig. 3



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Published June 8, 1943

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ALIEN PROPERTY CUSTODIAN

FEEDING OF MOTORS

Jean Gustave Antoine Marie Joseph Meyer, Neuilly, France; vested in the Alien Property Custodian

Application filed September 24, 1941

The supply of fuel to pumping devices securing the flow of fuel to the carburettor of airplane motors is subject to a number of difficulties which are particularly encountered at high altitude and for the airplanes in which the tanks are substantially remote from the motor.

1. Influence of high altitude

The reduction of pressure which occurs as the airplane is ascending, causes the progressive evolution of the gases dissolved in the fuel at the level of the ground. The said gas bubbles accumulate in the higher parts of the conduits connecting the tanks to the header feeding the motor and cause within the said header voids producing obstruction effects which are so much more substantial that:

The loads available are lower,

The conduits connecting the tanks to the header are longer.

2. Influence of the arrangement of the tanks

The arrangements of the tanks, which are now placed in the wings for aerodynamic purposes, is located with respect to the header in unfavourable conditions of flow.

In fact, the difference in level between the header and the tank is necessarily very low.

Furthermore, in large airplanes the conduit connecting the tank to the header is rather long. Thus the flow of liquid takes place under small load and high resistance.

At the ground the said arrangements are able to secure the normal flow of the fuel until the header.

However, in flight, two phenomena take place: the one which has already been mentioned in the first heading increases the braking effect due to the length of the conduit, the other one, resulting from the inertia stresses due to the displacement of the airplane and which can in some cases be higher than the motive load and completely stop the flow.

The present invention has for its object to obviate said disadvantages and consists in imparting to the fuel flowing out from the tank an additional potential energy by means of an external source of power, without increasing the pressure within the tank and without obstructing the section of the passage of the fuel.

Namely, the liquid which is coming out from the tank, passes into a pump, which is preferably a centrifugal pump, driven by a turbine, which is for instance operated by a displacement of the air due to the forward motion of the airplane, preferably by the displacement of the air within a conduit connecting the suction side to the pressure side of the wing.

By way of example the accompanying drawings show:

Fig. 1 the section of the wing of an airplane modified according to an embodiment of the present invention.

Figs. 2 to 4 three examples of application of the said embodiment.

Fig. 5 a view of a fourth embodiment.

Fig. 6 a section of the turbine of said fourth embodiment.

In all of said figures 2 to 6, the liquid which is coming out from the tank 2 is brought by means of the conduits 8 in the suction chamber of a centrifugal pump, in which the rotor 1 imparts to the liquid an additional potential energy and forces it in the conduit 7, which supplies the said liquid to the header 3 of the feeding pump of the motor not shown.

In the case of figure 2, the rotor 1 is carried by a shaft 10 which is at its opposite end rigidly connected to a hollow shaft 11 carrying the vanes 5 of a turbine, upon which is acting the air current formed by the difference in the pressures of the air available between the ends of the conduit 13 connecting the pressure side to the suction side of the wing 15 (figure 1). The conduit 13 bears upon the pressure side of the wing on a flange 16 integral with the tank 2 and on the suction side of the said wing by means of a stuffing box 17. The pump, the turbine, the adjacent conduits and the various pivots, form a unit independent from the tank 2. The air penetrating by the conduits 12, is directed by the distributor 6 upon the vanes 5 of the turbine and escapes by the apertures 14.

In order to avoid the tight joints which would absorb too much power, the casing of the rotor of the pump 1 is provided with a balancing shaft 9 extending to a head which is higher than the head which the fuel can reach within the tank 1.

In the case of figure 3, the vanes 5 of the turbine are located at the upper end of the shaft 10, thus enabling to suppress the hollow shaft 11. The same references number show in figure 3 and in figure 2 the same parts.

In the case of figure 4, the vanes 5 of the turbine are, as in the case of figure 3 arranged at the top of the shaft 10, the turbine is of the peripheral admission type instead of being of the axial type, thus facilitating its construction. In this case, the air, instead of passing within a single conduit 13, flows within four conduits 13',

arranged symmetrically in pairs about the shaft 10 which crosses the tank 2.

In the case of figures 5 and 6, the rotor 1 is carried by a shaft 10 ending in a hollow cylinder 10', provided with two slits 10''. Through the said slits 10'' is extending a rod 11', integral with the shaft 11 of the vane turbine 5, the said shaft 11 penetrating within the cylinder 10'. A spring 20, arranged within the cylinder 10', prevents the axial displacements of the shafts 10 ıd 11. The air current, generated by the mo ›on of the airplane, penetrates by the funnel-shaped conduit 12, flows within the snail 21, feeding the distributor 6. The air drives the blades 5 of the turbine and flows out at the center by the conduit 14.

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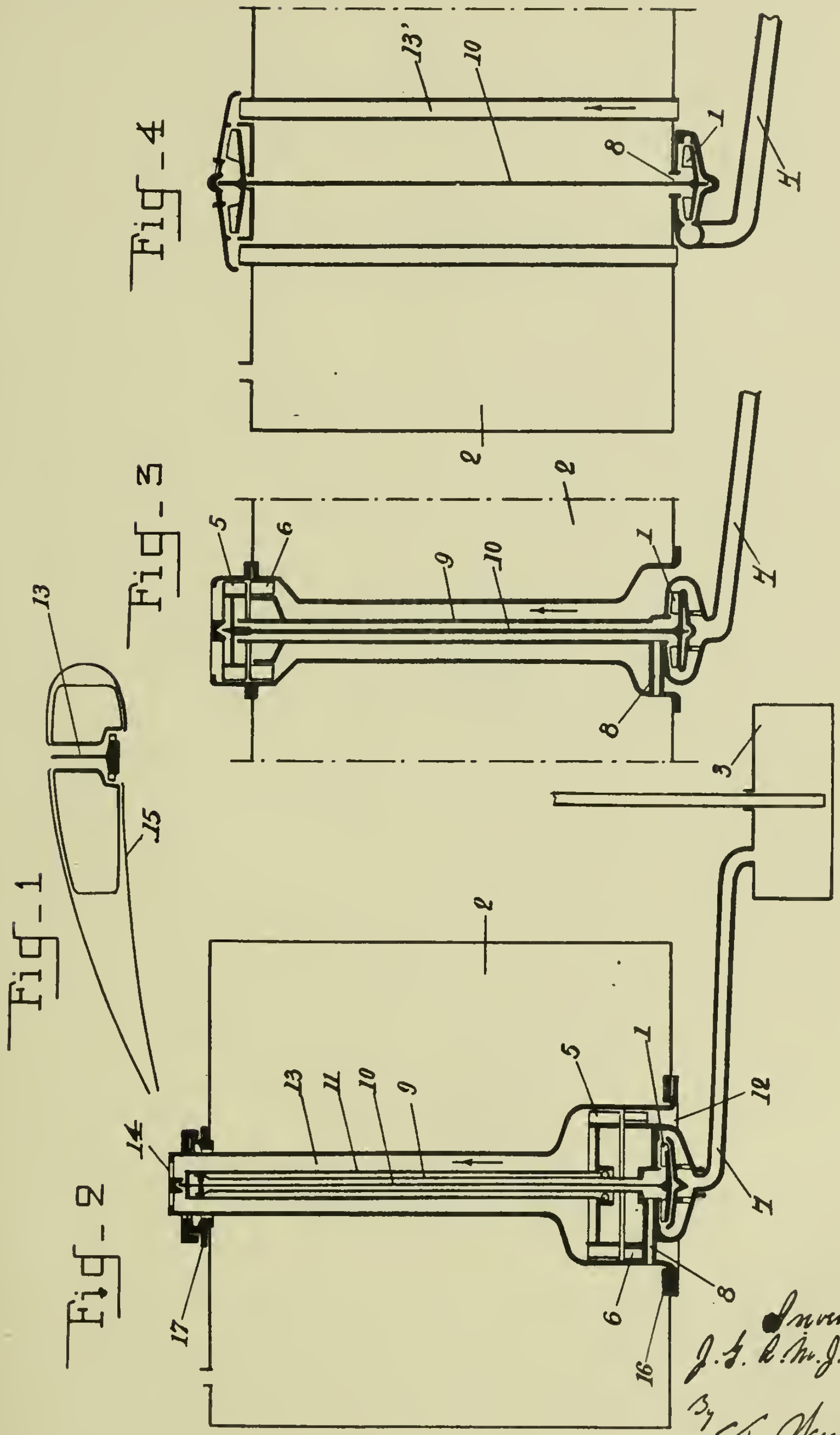
2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 5.

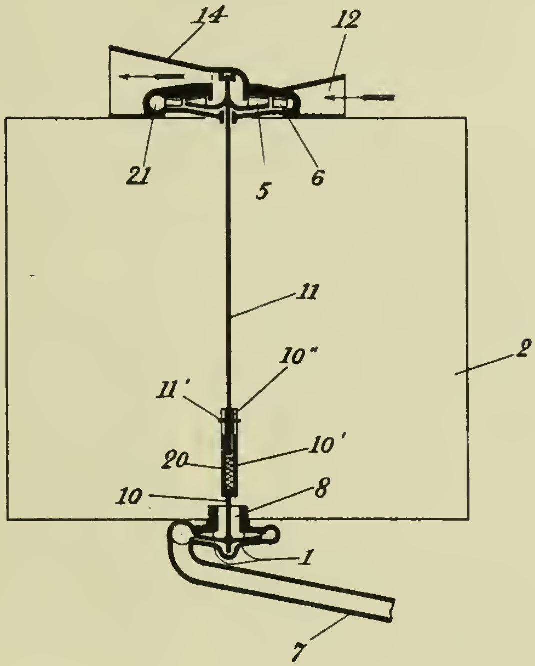
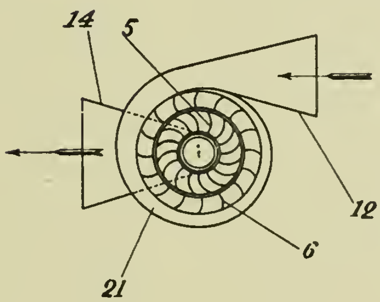


Fig. 6.



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ALIEN PROPERTY CUSTODIAN

CENTRALIZED REMOTE CONTROL SYSTEMS FOR PIPING NETWORKS

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Application filed September 25, 1941

The present invention relates to remote control systems for piping networks controlled from a central operating panel, more particularly intended for the distribution of fluids such as the fuel or lubricating oil on airplanes.

The constant increase in the dimensions and power of aircraft has for result, among others, an increase of the extent and complexity of the piping networks connecting the tanks to the engines. The valves controlling said network are often numerous; furthermore their direct control is frequently impossible or difficult, this necessitating the use of remote control devices. Now, mechanical remote controls of a certain extent are costly and difficult to establish; they are frequently stiff to manipulate and doubtful in operation, requiring constant maintenance. Moreover, owing to their weight and to their cumbersomeness, they must have a minimum of length, and this condition prevents the centralizing of control or its appropriate grouping, so that errors and accidents are possible.

The present invention concerns a remote control system of the pneumatic type, for valve devices or other elements of a fluid distribution network, which remedies these drawbacks.

This system comprises, according to one feature of the invention, in combination with a plurality of valves or other members to be actuated, which are pneumatically controlled, a source of compressed air or other fluid under pressure, pilot valves, preferably of the push-button type, in communication with said source of compressed air and with said pneumatically operated control valve devices, lamps or other signalling means capable of being actuated by the positions of said pneumatically operated control valve devices and a control or supervision panel on which are grouped according to any suitable diagram the pilot valves and the lamps or other signalling means corresponding to the various apparatus to be actuated.

According to an important feature of the invention the control valve device or said system, provided for any liquid or gaseous fluid, and capable of being controlled from a distance by means of impulsions of compressed air or gas or other fluid, is characterized, in particular, by the fact that it is arranged in such a manner that the control is effected by means of a single pilot pipe enabling of alternately and positively obtaining the opening and closing operations.

Another feature consists in the fact that said pneumatically operated control valve device is capable of being actuated in the desired direction by means of a direct hand control, independent of the compressed air control and which can eventually be used as emergency control.

According to a further feature, the valve device comprises electric contacts, indicating on a panel by suitable means (lamps or movable signals), the kind of operation effected, when said operation is effectively accomplished.

In the accompanying drawings, given by way of example:

Fig. 1 shows the diagrammatic arrangement of a distributing network according to the invention.

Figs. 2 and 3 illustrate in vertical section an embodiment of the remote controlled valve device.

Fig. 4 is a plan view thereof.

Figs. 5 and 6 refer to a modification.

Figs. 7 and 8 illustrate the hand control.

In Fig. 1, reference **91** and **92** designate fuel tanks respectively provided with stop valves **73** and **74** and capable of communicating either with the feeding pumps **75** and **76**, through the piping **77**, or with other tanks or other distributing members through the intercommunicating pipe **78** which can be stopped by the valve device **79**. Two valve devices **80** and **81** respectively control the output of the pumps **75** and **76** through the piping **82**. It will be assumed that the remote control valve devices **73**, **74**, **79**, **80** and **81** are pneumatically controlled; their more detailed description is given hereinafter.

On a control and supervision panel **83** is reproduced the general diagram of the piping networks in which the valve devices and other members to be controlled are represented by lamps **103**, **104**, **109**, **110**, **111** respectively corresponding to the valve devices **73**, **74**, **79**, **80** and **81**.

A compressed air container **89** or other source of fluid under pressure is connected to pilot valves preferably of the push-button type **203**, **204**, **209**, **210**, **211** arranged on the panel **83** and said pilot valves are connected by distinct pilot tubes **303**, **304**, **309**, **310**, **311**, to each of the pneumatic valve devices or corresponding remote control apparatus **73**, **74**, **79**, **80**, **81** respectively. The lamps **103**, **104**, **109**, **110**, **111** are moreover connected by electric signalling circuits **403**, **404**, **409**, **410**, **411**, to contacts provided on the pneumatic valve devices, as will be shown later on.

Each of the remote control pneumatic valve devices is designed as illustrated in Figs. 2 to 6. As shown in Fig. 2, it comprises a body **1** carrying the inlet opening **2** and the outlet opening **3** for the fluid to be controlled. These two open-

ings are separated by a partition 4 in which is housed a member 5 forming a seat for a movable valve element and preferably consisting of a ring of plastic material. On the valve seat bears a movable valve element 6 subjected to the action of the spring 7 which tends to close the valve by taking a bearing on the plug 8, which closes the lower part of the body 1 of the valve device.

On this valve body 1 is mounted by means of four studs 9, shown in Fig. 4, the cover 10 of the valve device, in which is housed the mechanism pneumatically controlling the movable valve element. This mechanism comprises a hollow piston 11 freely sliding in the cover 10. A fluid-tight leather washer 12 is clamped about said piston by a ring 13 screwed in the cover.

On the piston 11 is secured at the upper part, a coaxial tubular member 14 terminated by a bottom 15 comprising a rod 16 on which is mounted by means of the spindle 17 a member 18 of spherical shape and carrying the movable valve element 6.

At its upper part, the piston 11 is moreover connected in a fluid-tight manner to the end of an elastic bellows 19 the other end of which is tightly connected to a cup 20 secured to a socket 21 centered in the body 1 of the valve device and held in position by clamping the studs assembling the cover and the valve body. Said socket 21 serves as abutment for the piston 11 and limits its downward displacement. It comprises a ring 22 in which are provided openings allowing atmospheric pressure to reach the outside of the bellows 19.

The member 15 is connected on the one hand, to the movable valve element 6 and on the other hand to a plunger 23, for instance through the medium of the tapered base 24 and the pins 25. The plunger 23 slides vertically in a cylindrical guiding socket 26 provided in the cover 10 of the valve device, and terminates at the upper part by a hand operating knob 27. On a portion of its height from the base 24, the plunger contains a transverse slot 28.

In this slot is mounted a pawl 29 pivoted on a pin 30 and pushed by a spring 31. When the plunger 23 moves downwardly, the pawl engages one of the teeth of a ratchet wheel 32 which is journalled on a fixed spindle 33 fixed in the guiding socket 26 of the cover 10 and which passes in two longitudinal stud-holes 34 (see Fig. 4) provided in the plunger 23. The ratchet wheel 32 carries in its rotation a cam element 35 loosely mounted on the spindle 33, and maintained in its successive angular positions by the spring 36. According to said successive positions, the cam element presents either a notch, or a projection opposite the member 37 fixed on the base 24 and forms an abutment at different levels for said member 37.

The cover 10 moreover comprises an opening 38 through which is admitted the operating fluid under pressure used for the control. It comprises on the other hand, in a boss 39, an opening 40 obturated by a partition made of insulating material 41. Said partition is traversed by a terminal 42, forming a contact-piece embedded in the insulating partition, and by another terminal 43 forming the pivot for a rocking contact element 44. Said element carries an insulated pin 45 engaged in a circular groove 46 of the piston 11, so as to follow the vertical displacements of the piston; a cover 47 containing the passage of a wire, closes the boss 39.

Figs. 5 and 6 show in a partial longitudinal section and in a sectional plan view, a modification consisting in mounting at the upper part of the cover 10 of the valve device, a casing 48, the hand operating knob 27 being replaced by a knob 49 comprising a contact base 50 arranged opposite two springs 51. Said springs are secured by two contact-pieces 52 in a partition made of insulating material 53 secured in the boss of the casing 48. The boss is closed by a cover 54.

The push-button type pilot valve illustrated in Figs. 7 and 8 is composed of a body 55 carrying an opening 56 connected by a piping to the source of compressed air or gas, and an opening 57 connected likewise to the opening 38 of the valve device shown in Fig. 1.

In said body 55 is mounted a member 58 secured by the nut 59 and forming a valve seat 60 held on its seat by a spring 61. The member 58 comprises a central bore 62 through which passes, with an important clearance a rod 63, the base 64 of which, pushed back by the spring 65, is housed in the push-button 66. The push-button 66 is retained against the action of the spring 65 by a cup 67 secured on the body 55. The opening 57 connected to the piping of the valve device communicates through channels 68, 69, 62, with the chamber 70, which is in communication with the atmosphere through holes 71. The body 55 carries two attaching lugs for securing the knob on a panel.

The operation is as follows:

It will be assumed that the valve device 73 of Fig. 1 is under consideration and that it is controlled by the pilot valve 203. This pilot valve being in the position shown in Fig. 7, the valve element 60 rests on its seat, the piping 503 connecting the pilot valve to the control valve device is in communication with the atmosphere through the channels 68, 63, the chamber 70 and the holes 71. The control valve device 73 is in the position shown in Fig. 2, its movable valve element 6 being closed.

If the pilot valve 203 is acted upon in such a manner that the rod 65 spaces away the movable element 60 from its seat, the base 64 presses on the member 58 cutting off the communication of the channel 62 and of the chamber 70 with the atmosphere, and the pressure of the compressed air or gas coming from the container 89 is transmitted by the channels 69, 68, the joint 57 and the connecting piping 303 up to the opening 38 of the control valve device 73. This pressure acts within the cover 10 and causes the piston 11 to descend against the action of the spring 7, until it abuts on the ring 21. The movable valve element 6 connected to the piston 11 by the tubular member 14 also descends on and moves away from its seat 5. The valve device opens.

The pawl 29, connected to the piston 11 by its pin 30 secured in the slot 28 of the rod 23, participates in said downward movement and reaches, after a certain stroke, one of the teeth of the ratchet wheel 32 to which it imparts an indexing movement, equal at the end of the stroke, to the angular sector corresponding to said tooth. It results therefrom that the cam element 35, attached to the ratchet wheel 32, which was before in the position shown in Fig. 1 and one of the notches of which received the bearing surface 37 of the piston, assumes the position shown in Fig. 3, and one of its projections is now opposite said bearing surface 37.

When the pilot valve 203 is no longer pressed upon, the movable valve element 60 returns on

its seat and thus cuts off the arrival of compressed air or gas; the base 64 moves away from its seat on the member 58, and the pilot tube 303 is again in communication with the atmosphere, the pressure diminishes in the chamber of cover 10, and by the action of the spring 7, the movable valve element 6 acts on the plunger 23 and the piston 11, but the bearing surface 37 is stopped by the projection of the cam element 35, thus preventing the movable valve element 6 from returning on the seat 5. The valve device therefore remains open.

The upward stroke of piston 11 being thus stopped, the element 44 controlled by the pin 45 actuated by the piston 11 through the groove 46 remains in contact with the contact-piece 42 maintaining the electric circuit closed and consequently feeding the signalling line 403, which produces the lighting of the corresponding signalling lamp 103 on the control panel 83.

If, by means of the control knob 203, another impulse of fluid under pressure is transmitted through the opening 38 in the chamber of cover 10, said pressure acts in the manner above described, but the rotation which it imparts to the ratchet wheel 32 through the medium of the pawl 29, has for result to cause the cam element 35 to pass from the position illustrated in Fig. 3, (in which one of its projections is opposite the bearing surface 37) to the position shown in Fig. 2 (in which one of its notches receives the bearing surface 37).

Upon expansion of the fluid, when the pilot valve is no longer acted upon, said bearing surface 37 pushed back by the spring 7, effects a full upward stroke and enters one of the notches of the cam element 35 thus allowing the movable valve element 6 to be applied on its seat, which corresponds to the closed position of the valve device.

The upward stroke of piston 11 being thus accomplished the contact element 44 controlled by the pin 43 disengages from the contact-piece 42 thus opening the electric circuit of line 404 and extinguishing the signalling lamp 103 on the panel 83.

It will be noted, on the other hand, that if the knob 27 of Fig. 2 is acted upon by any means, for instance by hand, the same relative movements as those resulting from the action of the compressed air on piston 11 are produced by the pawl 29 and the ratchet wheel 32. Moreover, signalling takes place identically. Thus an emergency means is therefore available for the operation of the valve device, in case of accidental failure of the pneumatic control.

The operation of the apparatus illustrated in Figs. 5 and 6 and in which the valve device is provided with a device for grounding two electric circuits, is as follows:

The respective positions of the base 50 and of the contact springs 51, are such that the springs are in contact with the base when the valve device is closed, and separated from said base when the valve device is open. Therefore, if said springs, through the medium of the contact-piece 52 and of a conducting wire are, for instance connected to the earth contact of an ignition circuit of an airplane engine, said circuit will be grounded when the valve device is closed.

If, for instance, the considered valve device controls the delivery of oil to an airplane engine, the latter cannot be started if the valve device is not open, this avoiding any possibility of false operation, liable to cause a serious accident.

It is obvious that the invention is not limited to the embodiments as illustrated or described, which have been chosen only by way of example. The indicating panel may carry any diagram according to requirements, for instance it can indicate the normal or conventional order of the exhaust of various tanks, or any other arrangements capable of avoiding errors of operation. Said panel may comprise any signalling system. In particular, the luminous points supplied by the lamps can be replaced by movable signals or by luminous zones illustrating all the region of the diagram which is put in action or out of action.

On the panel, each push-button pilot valve can be connected by an arrow to the corresponding lamp, as illustrated in Fig. 1. It can also be placed directly on the diagram at the place corresponding to the pneumatic valve device to be actuated. Instead of push-button pilot valves, use can be made of any other operating member. The pneumatic devices can have flow controlling members of any type.

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ALBERT MOULET.

[illegible]

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J. L. L. A. A. MOULET
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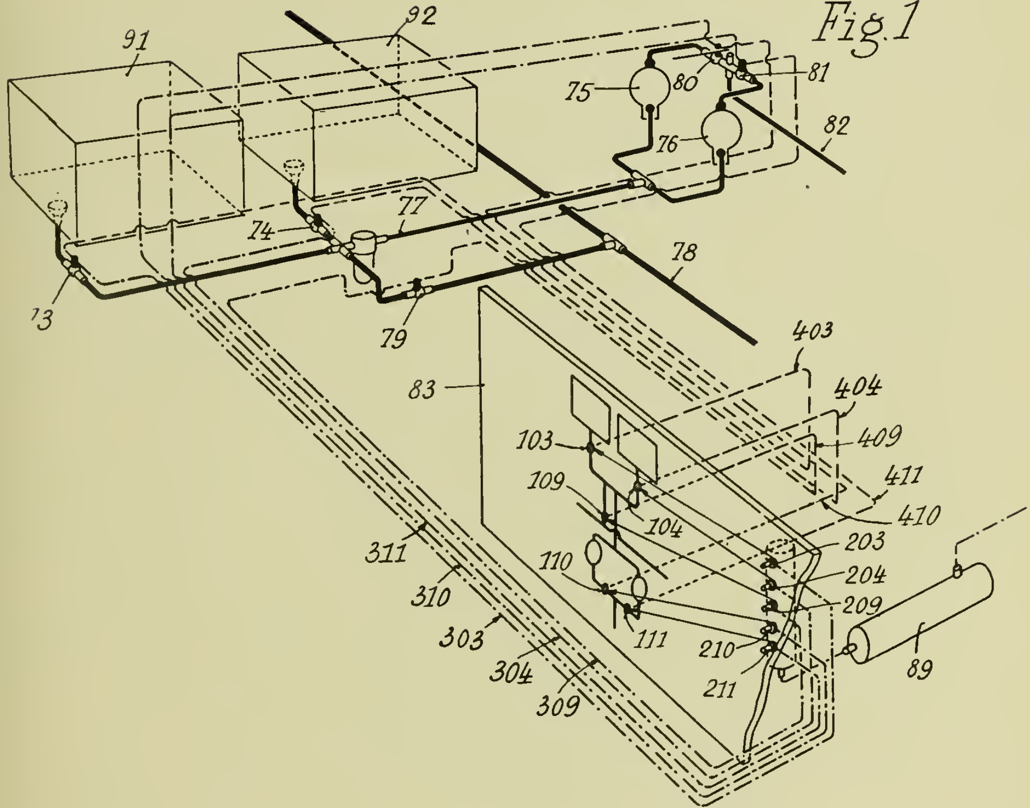
FOR PIPING NETWORKS
Filed Sept. 25, 1941

Serial No.
412,280

3 Sheets-Sheet 1

Fig. 1



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3 Sheets-Sheet 2

Fig. 2

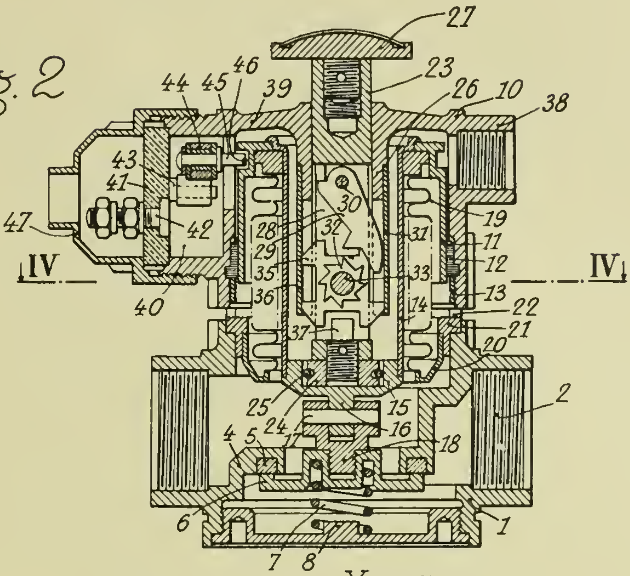


Fig. 3

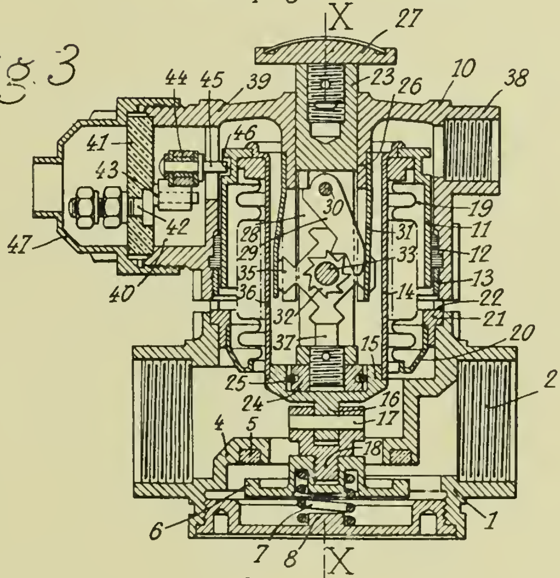
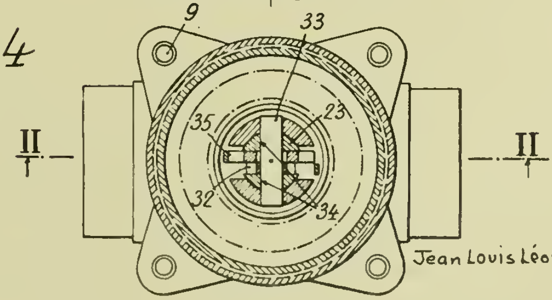


Fig. 4



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3 Sheets-Sheet 3

Fig.5

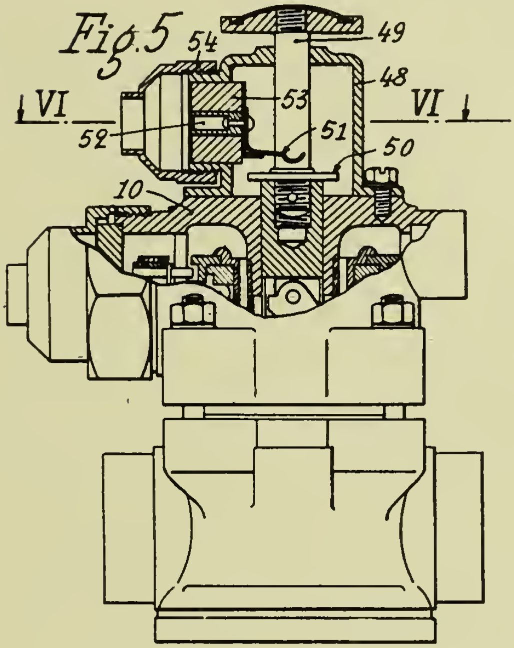


Fig.6

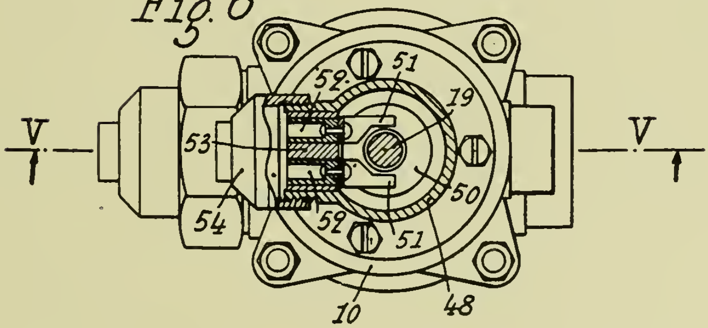


Fig.7

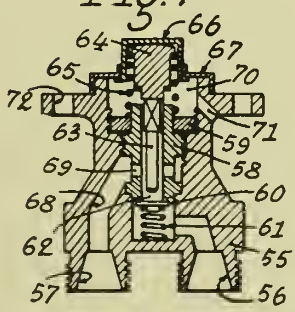
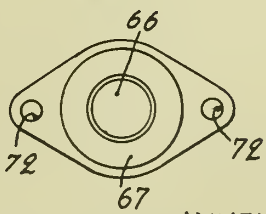


Fig.8



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ALIEN PROPERTY CUSTODIAN

CONSTRUCTION OF TURBO-MACHINES

Jérémi Malczewski, Lyon, France; vested in the Alien Property Custodian

Application filed September 26, 1941

The present invention relates to the construction of turbo-machines, such as turbo-compressors, turbines and the like, and it is more especially concerned, among these machines, with compressors for airplane engines.

The chief object of the present invention is to provide a machine of the type above mentioned which is better adapted to meet the requirements of practice, and, in particular, which is simpler and less expensive to manufacture than those made up to the present time, while being more efficient.

According to an essential feature of the invention, the rotor and/or the stator of such a machine is constituted by a plurality of metal sheet elements, suitably cut and stamped, and assembled together by electric welding, and preferably, spot welding.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 diagrammatically shows, in elevation and partly in axial section on the line I—I of Fig. 2, a turbo-compressor made according to the present invention;

Fig. 2 is a half-plan view, with parts cut off, corresponding to Fig. 1.

The turbo-compressor which will now be described with reference to the accompanying drawings is supposed to be intended for use on an airplane engine.

Concerning the rotor of this compressor, it includes a central cylindrical sleeve 1, on which is welded, close to one of the ends thereof, a flange or disc 2, provided with circular ribs 3 which increase the rigidity thereof and constitute baffles capable of preventing leakage of fluid along the surfaces of junction with fixed parts of the compressor.

On flange or disc 2, I fix, by electric welding, for instance by spot welding, an annular element 4, formed from a thin sheet of metal, preferably high resistance steel, the electric welding being performed with electrodes having active surfaces which are active or different, concerning their area and their shape, which makes it possible to obtain an assembly of the pieces without deformation and without regeneration of the welded metal.

Around the central sleeve 1, I distribute, in a regular manner, contiguous vanes, advantageously constituted of stainless and perfectly polished steel, each of these vanes being advantageously made as follows:

a. Either it consists of a box-like element 5, of U-shaped cross-section, obtained by cutting and stamping a metal sheet.

b. Or it made of a box-like assembly obtained by means of two U irons welded edgewise on a common metal sheet acting as a support for them and disposed so that the recesses of the U irons face each other respectively.

Each of these vanes is fixed on annular part 4 in such manner that the curvilinear bottom of the vane can be fixed by electric welding and for instance, by spot welding on the one hand on the central sleeve and on the other hand on annular part 4.

When the vane is constituted by a boxlike element 5 of U-shaped cross section, the upper edges of the sides of the U may be bent inwardly in such manner as to form supports 6 for an annular element 7, made of one or several parts, which covers the outer end of the vanes and is fixed thereto, and more especially to supporting portions 6 by electric welding. This annular element 7 is covered with an assembly annular element 8 which is provided with one or more circular ribs or ridges 9 adapted to increase the rigidity of the whole device.

On the inner face of the central sleeve 1, I provide means adapted to permit of driving the rotor.

These means may be made in any suitable manner, but preferably, according to the embodiment illustrated by the drawing, they are constituted by elastic ribs 13 of semi-circular transverse section, obtained by winding about a cylinder a thin metal sheet provided with suitable corrugations, either regular or not, the cylindrical piece thus obtained being connected, for instance by welding, to the inner wall of the central sleeve or shaft 1 of the rotor.

Concerning the stator of the compressor, it may be constructed in any suitable manner and, for instance, in the usual manner.

However, I prefer to make it of a construction analogous to that above described with reference to the rotor, so that said stator is made of a plurality of stamped metal sheet elements assembled by electric welding, these elements being preferably made of stainless steel and being perfectly polished.

In this case, as shown by the drawing, I mount on an annular support 10, a plurality of vanes 11. The support is for instance constituted by a

stamped piece, of U-shaped cross section. It is of course stationary. As for the blades **11**, they are made of metal sheet elements bent at right angles and spot welded to the support in question in the proper positions.

Furthermore, it is advantageous to fix on the upper face of support **10** one or several pieces **12** made of a thickness corresponding to that of the metal sheet elements which constitute the stationary vanes **11**. These pieces **12** are cut off in such manner that their outer edge is circular and coincides substantially with the outer edge of support **10**, while their inner edge is in the form of saw teeth so as to coincide substantially with the outline of the lower part of stationary vanes **11**. With such an arrangement, the surface which carries the fixed vanes is wholly plane and without projections, which considerably increases the efficiency of the compressor.

The compressor thus constituted is completed by a stationary envelope, inlet and exhaust conduits for the fluid to be compressed and means for driving the rotor.

Whatever be the particular detail arrangement that is chosen, I obtain a compressor the operation of which results sufficiently clearly from the preceding explanations for making it unnecessary to enter into further description thereof. Such a compressor complies with the conditions above stated, and the chief elements thereof, to wit the rotor and the stator, can be constructed in an economic manner, contrary to what took place up to now for similar devices, which were made of steel or light alloy pieces, obtained by stamping and machining.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

JÉRÉMI MALCZEWSKI.

PUBLISHED

JUNE 8, 1943.

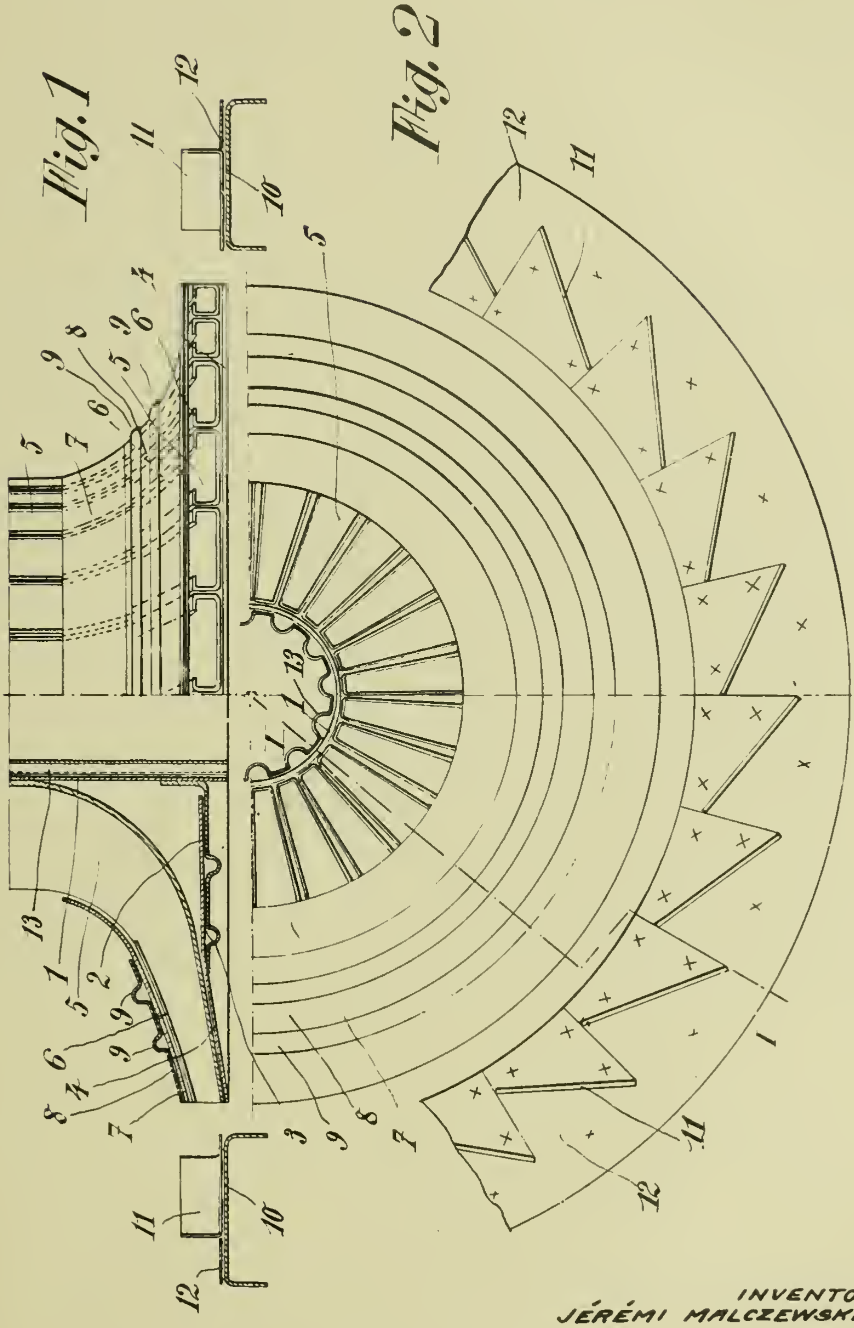
BY A. P. C.

J. MALCZEWSKI

CONSTRUCTION OF TURBO-MACHINES

Filed Sept. 26, 1941

Serial No. 412,528



INVENTOR
JÉRÉMI MALCZEWSKI,

BY Robert B. Larson
ATTORNEY

Published June 8, 1943

Serial No. 412,872

ALIEN PROPERTY CUSTODIAN

FEEDING DEVICE FOR TELEGRAPH RECEIVERS

Kurt Winkelmann, Berlin-Zehlendorf, Germany; vested in the Alien Property Custodian

Application filed September 29, 1941

This invention relates to a feeding device for paper tapes adapted for use in telegraph receivers.

In the known telegraph receivers the feed device consists of a feed roller and of a pressure roller for the paper tape. The feed roller is driven and seizes the paper tape pressed by the pressure roller and advances it.

The known receivers have the disadvantage in that the text printed is often obliterated by the pressure roller and that it is not visible to the viewer.

The invention removes these drawbacks by the fact that the pressure roller and/or the feed roller is designed in the form of a disk which seizes the paper tape only at one longitudinal edge. Preferably the disk seizes the paper tape only at the side away from the viewer.

An embodiment of the invention is shown in Figs. 1 and 2 in diagrammatic form, in which Fig. 1 is a lateral view and Fig. 2 a top view of the telegraph receiver.

The paper tape 1 runs under the recording spindle 5 over the speed roller 3 and pressure roller 4 which is pressed against the feed roller 3 by a lever 6. The pressure roller 4 contacts with the paper tape 1 only at the inner edge so that the characters which appear on the paper tape do not become obliterated. Furthermore, the characters are completely visible. The drive of the recording spindle and of the feed roller is not shown. It is effected in a known manner.

Of course, the invention is not only applicable to facsimile receivers in which a spindle is employed, but also to receivers with a type wheel or for the transport of Morse slips. Instead of the pressure roller also the feed roller may, of course, be designed in the form of a disk.

KURT WINKELMANN.

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K. WINKELMANN
FEEDING DEVICE FOR TELEGRAPH RECEIVERS
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412,872

Fig.1

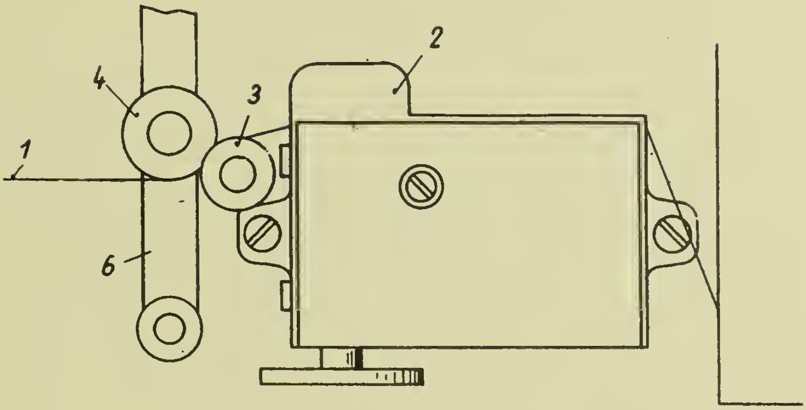
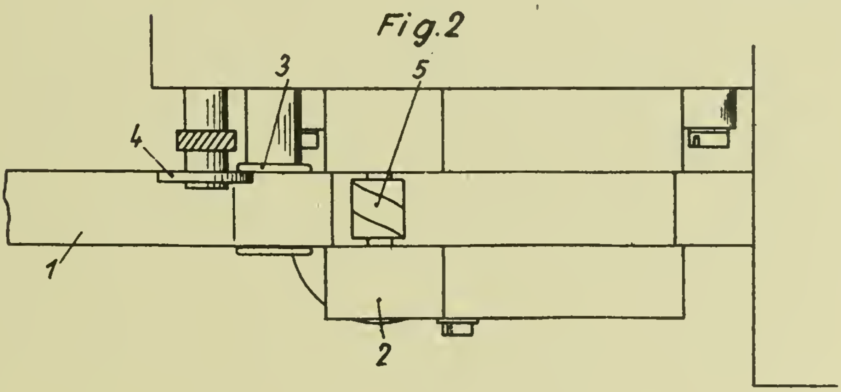


Fig.2



Inventor
Kurt Winkelmann
By Frederick E. Bauer
Attorney

Published June 8, 1943

Serial No. 412,526

ALIEN PROPERTY CUSTODIAN

DEVICES FOR CONTROLLING MULTIPLE SHUTTERS

Jérémi Malczewski, Lyon, France; vested in the Alien Property Custodian

Application filed September 26, 1941

The present invention relates to devices for controlling multiple shutters, such as those used for regulating the flow of cooling air into the hoods of engines, and especially aircraft engines. These shutters being mounted for instance along at least a portion of the periphery of said hoods in such manner that their opening may take place in the manner of a fan-like spreading, or, in a more general manner, by displacement of the respective shutters away from one another.

The object of the present invention is to provide a control device of this kind which is better adapted to meet the requirements of practice, in particular from the point of view of the facility of operation thereof and of the simplicity of its mounting.

With this object in view, according to an essential feature of the present invention, the device in question includes at least one electric motor, preferably mounted in close proximity to the shutters and capable of producing the displacement thereof away from one another, or, on the contrary, their movement toward one another, through a suitable kinematic system.

According to another feature of the present invention, the device in question includes an irreversible kinematic system, for instance of the ·ck type, preferably operated by an electric motor according to the feature just above mentioned, the whole being combined in such manner as to permit of bringing the shutters into any desired position.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic elevational view of a system of adjustable shutters for an airplane engine hood, provided with a control device made according to the invention;

Fig. 2 separately shows, in elevation, a part of the control device in question, on an enlarged scale;

Fig. 3 is a detail view showing, in section some of the parts of this device, made according to an embodiment of the invention;

Fig. 4 is a view, analogous to Fig. 3, showing another embodiment.

As above stated, the device according to the invention is intended to control the adjustment of a system of movable shutters intended to vary the flow of the cooling air, in an internal combustion engine, and especially an airplane engine.

Concerning the shutters themselves, which are diagrammatically shown at A on the drawings, they are made in any suitable known manner. For instance, they may be pivoted to the corresponding edge of the hood or hood portion that corresponds with said shutters. They may also be secured to this wall of the hood, their own elasticity then acting as an articulation, as set forth in the French Patent No. 829,451, filed by me on Nov. 18, 1937.

In Fig. 1 of the drawings, I have shown shutters which extend over 180° of a hood of circular section, such an arrangement being given merely by way of example.

Concerning now the means for producing the opening or the closing of this system of shutters, said means include, according to the invention, at least one electric motor, adapted to run in both directions, mounted in close proximity to the parts to be controlled, and this motor is arranged to act on a kinematic system capable of bringing the shutters away from, or toward, one another.

In order to obtain this result, it is advantageous, according to a preferred embodiment of the invention, to have the whole of the control device carried by the shutters themselves. For instance, the motor **1** itself is carried by the middle shutter, as shown by Fig. 1. Such an arrangement permits of reducing to a minimum the room occupied by the device in the annular space through which air is escaping.

As for the kinematic system through which the motor acts on the shutters, it is advantageously made in such manner that it is irreversible, so as to permit of ensuring the stability of the whole, in any position whatever thereof.

In the embodiment illustrated by the drawings, the system in question includes one or several bolt-and-nut units, adapted themselves to act on movable or deformable parts capable of producing the desired relative movements of the respective shutters.

In the drawings (Figs. 1 to 3), there is shown a device including a motor **1**, preferably fitted with a speed reducing gear **3**, **2**, arranged to drive spindles **4**, **4**. These spindles in turn drive, through Cardan joints, designated by **5**, threaded rods **6** coacting with nuts **7**. These nuts control the displacements of two curved tubes or rods **8**, pivotally mounted at **9**, which are connected to the respective shutters, or at least to some of them, through lugs such as **10**, in which said tubes **8** are slidable.

It will be readily understood that, provided that lugs 10 are mounted at a suitable distance from the axis about which each of the shutters can move with respect to the fixed wall of the hood, the movements of tubes 8 away from, or toward, each other (which movements are produced by the relative displacements of the screw and the nut) will have for their effect to spread out, or on the contrary, to gather, the shutters.

Fig. 1 diagrammatically shows these two positions, the first in dotted lines, the second in solid lines.

It should be well understood that, in the known manner, the respective shutters may remain in bearing contact with one another, in the course of their spreading movement, and this through any suitable means.

The motor and its speed reducing gear will be mounted in cases.

In Fig. 3, I have shown details of the screw-and-nut system, according to an embodiment of the invention.

In this example, nut 7 is rigid with a sleeve 11, itself fixed to the corresponding end of tube 8. A sliding member 12 is adapted to move in said sleeve, in such manner as to guide threaded rod 6 therein.

Preferably, this threaded rod is prolonged on both sides by smooth portions 13 and 14, in such manner as to make it possible for the motor to keep running without interference, after full opening or closing of the system has been obtained.

In Fig. 4, I have shown a modification according to which the screw and nut units are mounted directly on spindles 4, on the inside of sleeve 15 which constitute extensions of the casings of the motor unit.

Each of the nuts 7 controls, through lugs 16 extending through slots 17 provided in sleeves 15, a tubular extension 18 provided on the corresponding tube 8, this tubular element 18 being made of suitable diameter for permitting its relative movements with respect to sleeve 15.

This arrangement makes it possible to dispense with the Cardan joints, but of course other arrangements would permit of obtaining the same result.

Anyway, whatever be the particular mechanical arrangement that is chosen, I obtain a device the operation of which results sufficiently clearly from the preceding explanations for making it unnecessary to enter into further explanations. This device has, over those used for the same purpose up to the present time, many advantages, the most interesting of which are the following:

Any operation of the device can be performed in the minimum time;

A stable position of all the parts of the system can be ensured, which could not be obtained, without special means for this purpose, with existing control devices, as well mechanical as pneumatic or again as hydraulic;

Consequently, it is possible to bring and to keep the shutters, in any intermediate position, merely by starting and stopping, through any suitable means, at a given time, the electric motor which drives the whole system.

Of course, this motor will be fitted with all circuits of a known type which permit of reversing its direction of working, the whole being controlled from an instrument board carried by the airplane.

The stopping of the motor, at the end of the total displacement of the device, can be automatically controlled by the shutters themselves or in any other way.

Eventually also, any repeating or other suitable means may be provided for enabling the pilot to know, at any time, what is the exact position of the shutters (especially when they occupy an intermediate position).

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

JÉRÉMI MALCZEWSKI.

PUBLISHED | J. MALCZEWSKI | Serial No.
JUNE 8, 1943. | DEVICES FOR CONTROLLING MULTIPLE SHUTTERS | 412,526
BY A. P. C. | Filed Sept. 26, 1941 | 2 Sheets-Sheet 1

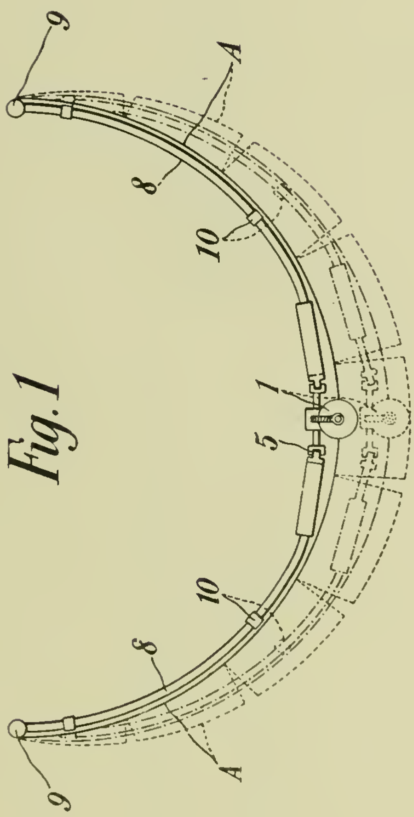


Fig. 1

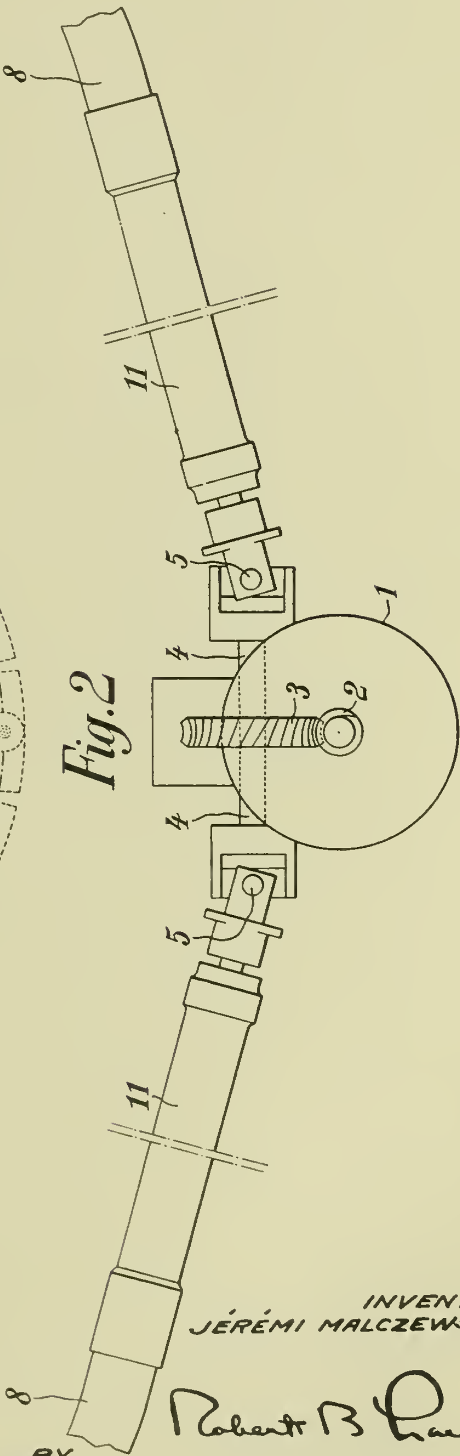


Fig. 2

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2 Sheets-Sheet 2

Fig. 3

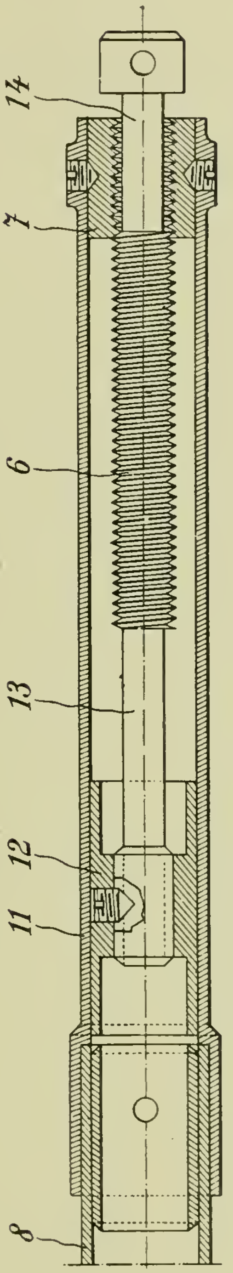
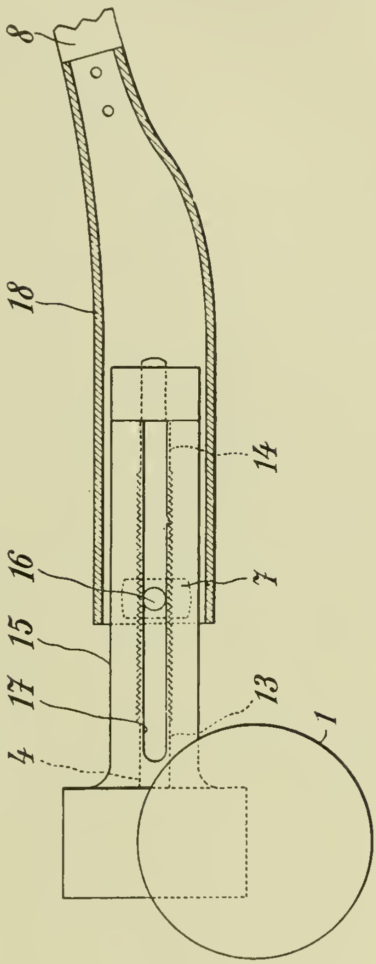


Fig. 4



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Published June 8, 1943 Serial No. 412,906

ALIEN PROPERTY CUSTODIAN

SEALING ARRANGEMENT FOR CENTRIFUGAL MACHINES

Ernst Gente, Berlin-Siemensstadt, Germany; vested in the Alien Property Custodian

Application filed September 29, 1941

This invention relates to a sealing arrangement for centrifugal machines.

In centrifugal machines, particularly in steam turbines with radial admission of the working medium it may often occur that disks exposed to a lateral overpressure not only must give up or absorb work, but that they seal at the same time the space in which a higher pressure prevails with respect to the space in which lower pressure prevails without thereby preventing the disks from freely expanding. The solution of the problem resulting therefrom is not always simple. The resilient ring body secured to the disk and shaft and which establishes a steam-tight seal between the two spaces, the pressure in the one space differing in value from that in the other space, has hitherto given satisfactory results. By the invention it is possible to avoid such additional sealing members or if they are to be retained for the sake of safety they must be so relieved of pressure that they may be designed considerably thinner so as to reduce the weight to a great extent, that is to say they oppose a correspondingly smaller resistance to the disk when being expanded. The solution of the invention consists in utilizing the overpressure itself so as to bring about the seal by providing an arrangement in which the disk is pressed against a sealing surface of a ring mounted on the shaft, the sealing surface being so dimensioned that even in the case of the slightest overpressure to be expected in operation the surface pressure necessary for a proper seal does not fall below a given value. To a certain extent it is therefore the over-pressure itself which replaces the sealing member hitherto employed.

As already mentioned the invention does not exclude the use of a sealing member, if it is believed that such a member cannot be dispensed with for certain reasons. In this case the sealing member may assume the form of a simple cylinder; however, it may also consist as has hitherto been usual of a resilient ring body. Such an embodiment is shown in Fig. 1 in diagrammatic form. The disk **1** which may be, for instance, the impeller of a steam turbine with radial admission of the working medium is so secured to the shaft **3** by means of keys **2** that the transmission of the torque does not prevent the disk from expanding and vice versa. The disk **1** is exposed to a lateral pressure in the direction as indicated by the arrow **7**. The space **9** must be rendered steam-tight with respect to the space **10**. To this end, a sealing surface **11** of a ring mounted on the shaft is employed according to the invention and is as above pointed out so dimensioned as is necessary in view of the lowest over-pressure to be expected. It might be assumed that an increase of the sealing surface would be unobjectionable. However, if the surface is too large the specific contact pressure becomes under circumstances so small that a sealing between the spaces **9** and **10** is no longer ensured. It is therefore essential that the specific surface pressure should not decrease below a value resulting from the operating conditions of the steam turbine.

However, for the sake of safety, the resilient ring **6** is in the present case in addition employed which is worked out from the material of the ring **7** and is held in position by the intermediate ring **4** and the nut **5**. As already mentioned, the resilient ring **6** is not absolutely necessary, but it only secures the seal brought about by the surface **11**.

Fig. 2 shows the same arrangement with a modified form of the additional sealing member. In this case, the sealing member is designed in the form of a simple cylinder **8** which may be so thin that the deformation occurring does not influence the expansion of the disk **1**. The inclined position of the disk, caused by the lateral overpressure and the effect of the centrifugal force of the disk bring about two opposed movements at the sealing point. If the two movements are equal no stress whatever occurs at the sealing body, since the radial displacement is zero.

The sealing body need not present a smooth surface but may also be spherical.

Owing to the high contact pressures to be expected it is preferable to case-harden, particularly to nitrify the supporting ring body at least at the sealing surface.

ERNST GENTE.

PUBLISHED

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BY A. P. C.

E. GENTE
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Fig. 1

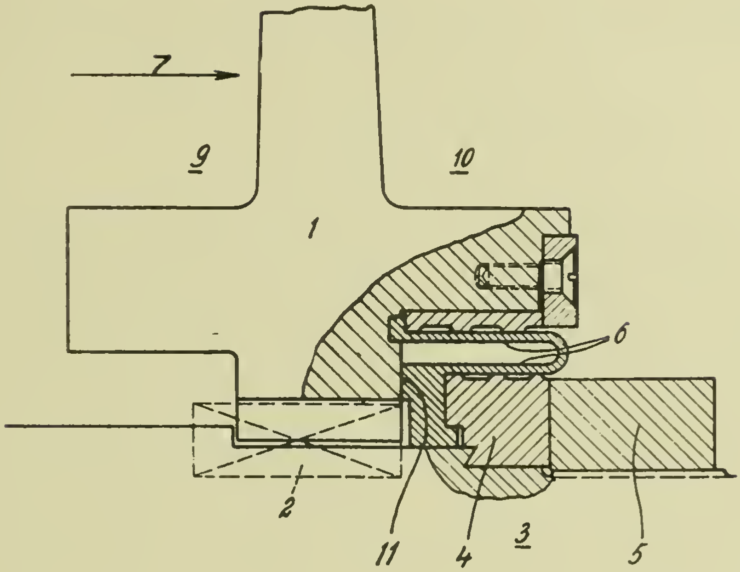
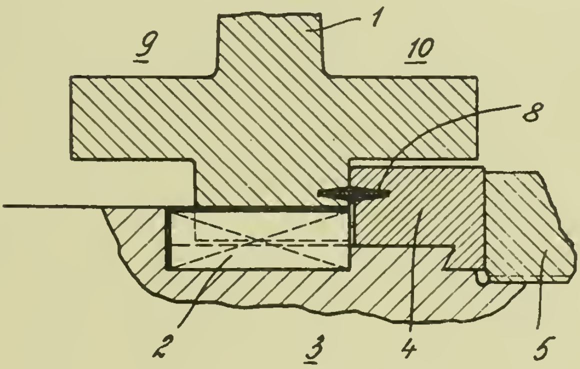


Fig. 2



Inventor

Ernst Gente

By Frederick E. Bauer

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ALIEN PROPERTY CUSTODIAN

TURBINE

Emile Dupont, Antibes, France; vested in the Alien Property Custodian

Application filed October 16, 1941

This invention relates to a turbine used for converting work into a pressure or conversely, where the manometric height used or produced by a single wheel is distributed over a plurality of concentric blade rims suitably spaced and arranged on one of the faces of the rotor and over a plurality of concentric blade rims arranged on one face of the stator and inserted into the ring spaces between the blade rims of the rotor, the flow of the fluid being a centrifugal flow when the machine converts work into a pressure (compression and fluid pumps) and an inward radial flow when the machine converts pressure into work (gas turbine, steam and water turbines).

In the known turbines of this kind the axial balancing is effected by means of a chamber between the face of the rotor without blades and a wall of the stator, and in which chamber the pressure is uniform and generally equal to the high pressure of the fluid. This is obtained by means of a passage provided in the rotor and insuring a communication between the said balancing chamber and the high pressure.

Thus, one of the faces of the rotor is submitted, for instance, to a uniform pressure, while the other face is submitted to decreasing pressures in front of each of the fixed and movable blade rims according to the working of the turbine as a compressor.

Accordingly, in these known turbines the resulting pressure, that is to say the difference between the pressures acting on both faces of the rotor varies according to the distance of the point under consideration with respect to the air.

The rotor is thus submitted in each of its points to resulting axial pressures the value of which differs from nil and which for this reason do not permit of obtaining a good balancing effect. In every case, the balancing effect is perfect only for a predetermined value of the highest fluid pressure and the least variation of this pressure determines an axial thrust.

The present invention has for its object to avoid drawbacks and to obtain a perfect axial balancing of the rotor in all the points of its surface.

On the other hand, turbines with concentric blade rims have generally blades with such a profile that two successive blades of one and the same blade rim form together a curvilinear nozzle, which in the case of a compressor is a divergent nozzle.

Now, this divergent nozzle must in this case act as a diffusor which owing to its small radius of curvature has a bad efficiency.

This drawback is due to the fact that the centrifugal force acting on the fluid vein tends to separate the said vein from the convex face of the blade, which causes eddies which are prejudicial to the efficiency.

Another object of the invention is still to avoid this drawback and to improve the known turbines so as to avoid any separation of the fluid vein from the convex face of the blade.

The improved turbine which permits to attain the above mentioned objects possesses the features resulting from the following description and more particularly from the appended claims.

Turbines made according to the invention are shown by way of example in the appended drawing in which:

Figure 1 is an axial sectional view of the turbine.

Figure 2 is a partial axial sectional view of the said turbine.

Figure 3 is a diagram showing the axial pressures in the turbo-compressor according to the invention.

Figure 4 is on a larger scale a cross sectional view through the blades with the parallelograms of velocities.

Figure 5 is a partial axial cross sectional view of another turbine according to the invention.

Figure 6 shows the lay-out of the blades of a turbine according to the invention.

The turbine shown in Figures 1 to 4 is mounted on a driving shaft **1**. A wheel **2** is keyed on the driving shaft **1**; the wheel **2** is profiled in its middle part according to a cone **3** the profile of which corresponds to that of the gaseous vein on the suction side of the apparatus.

The wheel **2** carries on its face 2^1 blade rims 4^1 4^2 4^3 4^4, the so-called movable blades; the profile of the said blades $4^1 \ldots 4^4$ (Figure 4) varies from one rim to the other and according to the characteristics of the apparatus (velocity, delivery), but they are always such that two successive blades of one and the same rim form a curvilinear nozzle.

The face 2^2 of the wheel which is not provided with blades carries circular ribs 5^1 $5^2 \ldots 5^7$ adapted for forming the axial balancing chambers.

The stator is provided with a slightly conical bracket **6**; this bracket carries fixed blade rims 7^1 $7^2 \ldots 7^7$ which are inserted between the movable blade rims $4^1 \ldots 4^4$, the fixed blade rim 7^1 being arranged externally with respect to the movable

blade rim 4^1. Like the movable blades, the fixed blades are so formed that two successive blades of one and the same rim form a curvilinear nozzle.

The stator is also provided with a bracket 8 which carries on one of its faces circular ribs 9^1 9^2 . . . 9^8 forming with the circular ribs 5^1 . . . 5^7 of the wheel 2 chambers 10^1 . . . 10^8 which are connected together by conduits of small section 11^1 . . . 11^7. A conduit 12 is provided between the fixed blade rim 7^1 and the movable blade rim 4^1; the said conduit connects the chamber 10^1 with the face 2^1 of the wheel 2.

The conduits 11 and 12 are formed by the necessary plays between the fixed and movable parts.

Passages 17^1 . . . 17^4 are provided in the wheel 2 and connect both faces of the wheel together in the place of each fixed blade rim 7^2 7^3 7^4 and of the ring chambers 10^2 10^4 10^6 and 10^8.

Counter-pressure chambers 35^1 35^3 35^5 35^7 are provided between the cover ring 36^1 36^3 36^5 36^7 of each movable blade rim and the bracket 6 of the stator.

The fluid is admitted through a conduit 13 provided in the stator and opening into an admission manifold 14; the fluid leaving the blades after compression is delivered into an outlet manifold 15 and flows out through openings 16 which are provided in this manifold 15.

The above described turbine works as compressor in the following manner:

The rotor rotates in the direction of the arrow f (Figure 4); a movable blade rim 4^4 and the fixed blade rims 7^5 and 7^4 which are directly on both sides of the former will now be considered. The fixed blades of the rim 7^5 which are so inclined as to insure the correct inlet of the fluid into the movable blades form a distributor. The fixed blades of the rim 7^4 act as a diffusor for the movable blade rim 4^4 and as a distributor for the movable blade rim 4^3.

Thus, each movable blade rim 4^1 . . . produces an independent compression as well as each fixed blade rim 7^1 . . . so that successive compression stages are formed seriatim.

The gaseous fluid which is thus drawn in through the axial conduit is progressively compressed by the fixed and movable blade rims before it escapes into the manifold 15, then it passes through a fixed blade rim 7^1 where the whole of the peripherical velocity acquired in the movable blade rim 4^1 is converted into pressure while retaining a velocity which is just sufficient for the necessity of the delivery. The so compressed fluid is collected in the manifold 15 and forced out through openings 16.

The power absorbed by each of the stages of the compressor is expressed by:

$$W=\frac{P}{g}(U_1V_1\cos\alpha_1-U_0V_0\cos\alpha_0)$$

where

P is the weight of fluid treated per second,

g the acceleration of the gravity,

U_1 the driving velocity on the periphery of the movable blade rim,

V_1 the absolute velocity of the fluid leaving the movable blade rim,

α_1 the angle formed by both these velocities,

U_0 the driving velocity at the inlet to the movable blade rim,

V_0 the absolute velocity of the fluid at this inlet, and

α_0 the angle formed by these two velocities.

The profile of the movable blades is selected so as to give to the angle α_0 a value of more than 90°; accordingly the term $U_0V_0 \cos\alpha_0$ has a positive value and is added to the term $U_1V_1 \cos\alpha_1$ in the above given formula, thus giving the power W.

The slight inclination of the movable blade rims 4 at the outlet in the front part of the movement has for its effect to cause the angle α_1 to tend to nil; the cosine of this angle α_1 tends to 1 and the value of the term $U_1V_1 \cos\alpha_1$ increases while tending towards U_1V_1 which is its maximum value.

Of course, the value of the angles $\alpha_0\alpha_1$ may vary while being limited by the considerations of working in the manufacture of the blades.

The axial balancing is effected in the following manner: the passages 17^1 . . . 17^4 connect the annular chambers 10^2 10^4 10^6 10^8 with the corresponding fixed blade rims 7^2 7^3 7^4 and 7^5 of the face 2 of the rotor and thus produce in the said chambers pressures which are equal to the pressures existing in the said fixed blade rims and acting on the face 1 of the rotor. In these places of the rotor the pressure is thus the same on the face 2^1 and on the face 2^2, thus producing the axial balancing effect.

On the other hand, the passages 11 connect the chambers 10^1 . . . 10^8 together so that in the chamber 10^3, for instance, a pressure is established which is intermediary to the pressures existing in the chambers 10^2 and 10^4 between which the said chamber is inserted. This intermediary pressure is the same as the pressure exerted by the chamber 35^3 on the cover ring 36^3 of the movable blade rim 4^2. This pressure is intermediary between the pressures existing in the fixed blade rims 7^2 and 7^3 between which the movable blade rims 4^2 are inserted; in a like manner the pressure in the chambers 35^1 35^5 35^7 corresponding to the movable blade rims 4^1 4^3 and 4^4 corresponds to an equivalent pressure in the chambers 10^1 10^5 10^7 opposite to the said movable blade rims.

Thus the pressures are equal in all points on each face of the rotor so that the axial balancing is attained in a perfect manner.

This regular distribution of the balancing effect is clearly shown by the diagram of Figure 3; to each pressure P_1 . . . P_n acting on the face 2^1 of the rotor which is provided with movable blades corresponds an equal counter-pressure of contrary direction P_1 . . . P_n acting on the opposite face 2^2 of the said rotor; thus an axial balancing effect is obtained in each point of the surface of the rotor.

Numerous changes can be made in the turbine shown in Figures 1 to 3 without departing from the spirit and scope of the invention.

Figure 5 more particularly shows a turbine according to another form of execution of the invention. The rotor 2 of this turbine is provided on its face 2^2 with annular chambers 18^1 18^2 . . . 18_n acting as balancing chambers. These annular balancing chambers are connected together by passages 19^1 . . . 19_n, the whole of the chambers 18 and of the passages 19 forming a labyrinth in which the fluid velocity acquired in one passage 19 is annihilated in the following chamber 18.

On the other hand, in the cover rings 27^1 27^2 of the movable blade rims, hollows are provided which form annular balancing chambers 22^1 22^2 22^3 and 24^1 24^2 24^3 with the wall 25 of the stator, the chambers 22 being connected together by the

passages 23^1 23^2 23^3 and the chambers **24** being connected together by the passages 25^1 25^2 25^3.

The cover rings **28** of the fixed blade rims are also provided with cavities forming with the wall **21** of the rotor annular balancing chambers 20^1 20^2 20^3 connected together by passages 21^1 21^2 21^3.

Passages 26^1 26^2 in any number are provided in the wheel **2** and connect both faces of the wheel together in the place of the balancing chambers 20^2 and 18^5, 20^3 and 18^6. Certain of these passages 26^1 are always arranged between the centre of the rotor and the first movable blade rim in order to connect the centre of the rotor with the suction side of the compressor and must have a sufficient section for leading the fluid leakage from the face 2^2 towards the face 2^1.

In the annular chambers, for instance 20^1 20^2 20^3 a flow of fluid will establish itself through the passages 21^1 21^2 21^3 so that the pressure existing in these chambers will be the same as the pressure existing in the blade rim 7^2. In short, this device establishes a pressure in the space between the cover ring of the blades and the stator in the case of a movable blade rim or between the blade cover ring and the rotor in the case of a fixed blade rim, which pressure is equal, on the one hand, to the pressure existing in the blade rim under consideration and, on the other hand, to the pressure existing in the corresponding chambers of the face 2^2 of the rotor, thus producing an axial balancing effect in all the points of the rotor.

This turbine offers various advantages and more particularly the following ones:

(*a*) A perfect balancing effect is obtained if the number of the chambers and the dimensions of the latter are the same for each face of the wheel;

(*b*) The tightness between two successive blade rims is increased, so that leakage is reduced and the efficiency increased.

For working as a compressor the invention avoids the drawbacks of the known blade rims by providing a particular form of blade rims (Figure 6).

The blades of these fixed and movable blade rims have an increased thickness **37** from the region of their bend up to their extremities; accordingly, the fluid vein remains always in contact with the convex surface **38** of the blade and thus the above mentioned separating effect due to the centrifugal force is avoided.

Blades show also on their outlet faces a cylindrical surface **39** which is so formed that the fluid vein **40** leaving the front blade rim leaves a partial vacuum zone **41** in the following blade rim.

The said blade rims offer the following advantages:

(*a*) The efficiency of the curvilinear nozzle formed of two successive blades of one and the same blade rim is increased since the fluid vein is not separated from the convex surface **38**, which avoids the formation of eddies in the said vein;

(*b*) The action of the centrifugal force in a curvilinear blade rim has for its effect that at A (Figure 6) the pressure is considerably higher than at B.

Thus the hollow face of a movable blade moving in the direction of the arrow receives fluid of a higher pressure, then the edge of this movable blade is suddenly in front of the rear edge of the fixed blade (position shown in Figure 6). Then, during the time which the movable blade requires for travelling along the segment *e*, its hollow face receives no fluid. Thus, the pressure drops along this hollow face due to the inertia of the fluid which it contained and which possessed a certain velocity, as well as to the friction of the vein which flows along the convex face of the preceding blade.

When the hollow face of the movable blade comes in front of the point B (front edge of the fixed blade) the pressure existing along this hollow face is nearer to that which exists in B.

The tendency of the fluid vein of flowing back which periodically occurs in blade rims made according to the usual technical methods, each time when a movable blade passes in front of a fixed blade, is reduced or even annihilated in the case of the invention. Eddies are thus less violent and the internal efficiency is therefore meliorated.

The invention covers this particular form of execution of the blades irrespectively of the kind of turbine or compressor in which the said blades are used.

EMILE DUPONT.

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JUNE 8, 1943.
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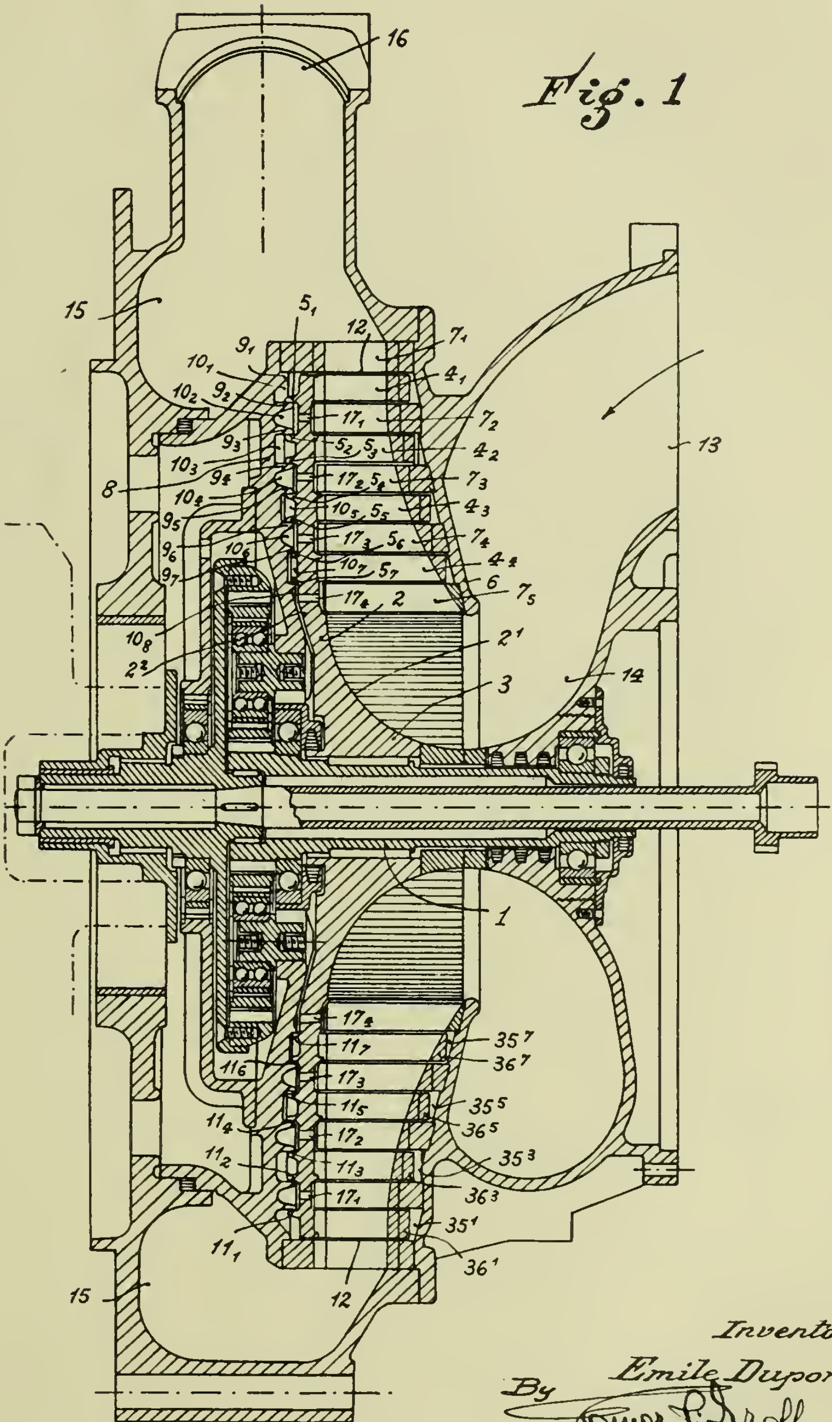
E. DUPONT
TURBINE
Filed Oct. 16, 1941

Serial No.
415,306
4 Sheets—Sheet 1

Fig. 1



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4 Sheets-Sheet 2

Fig. 2

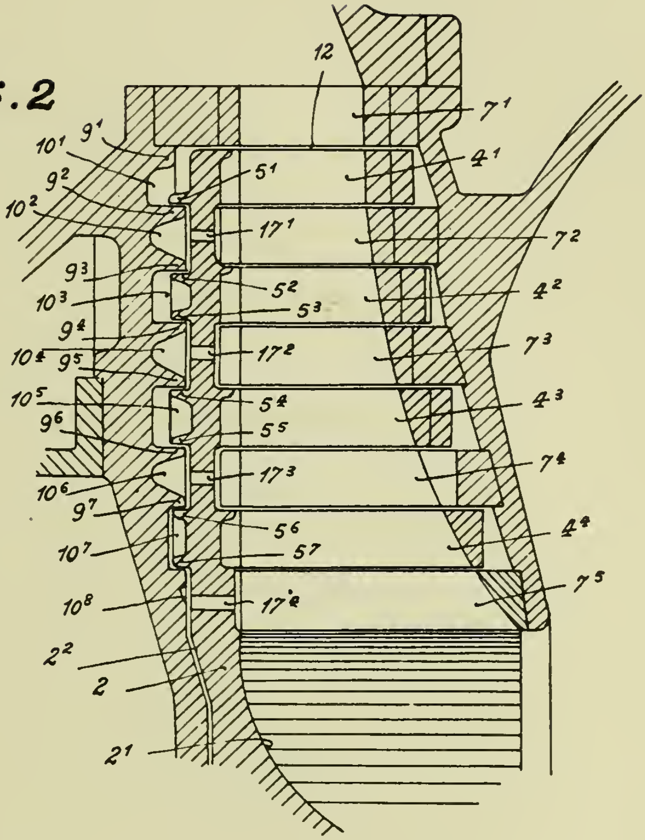

Fig. 3

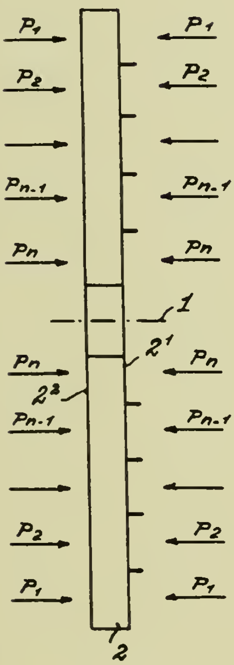

Fig. 6

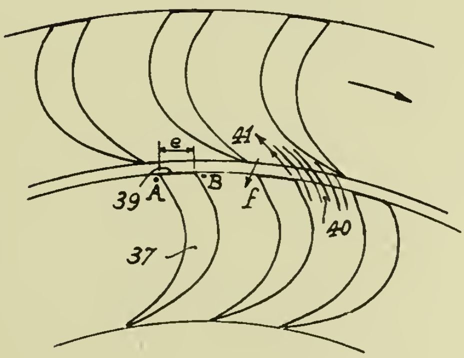

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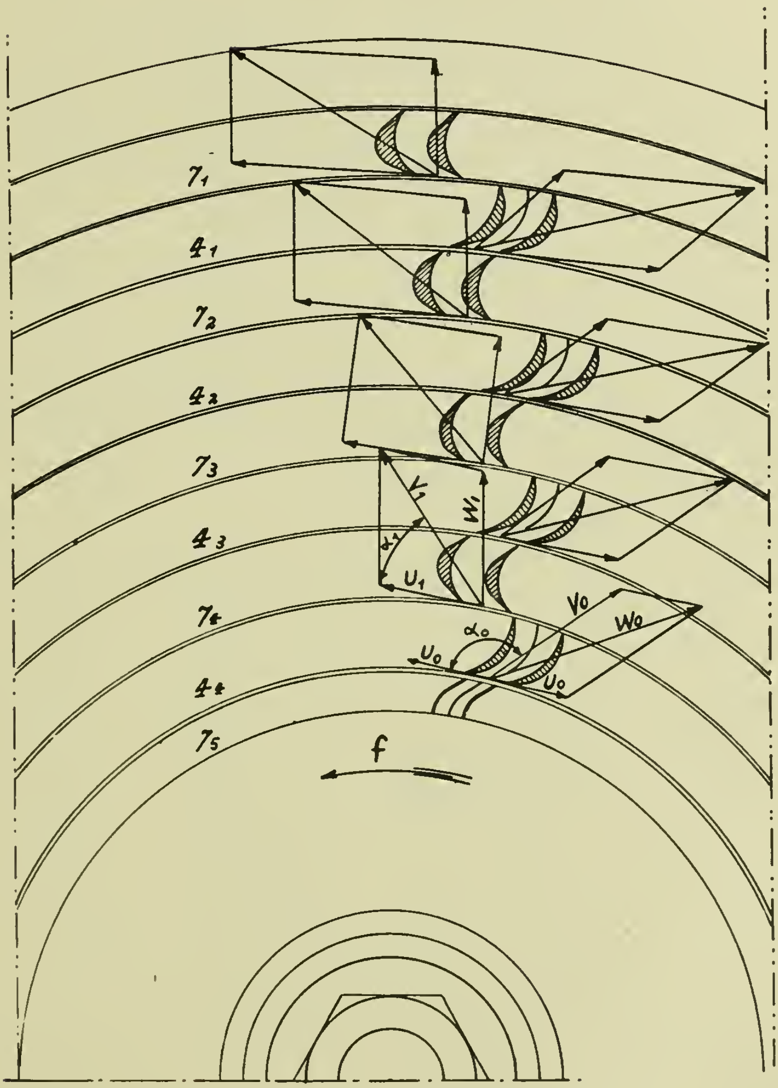
Fig. 4



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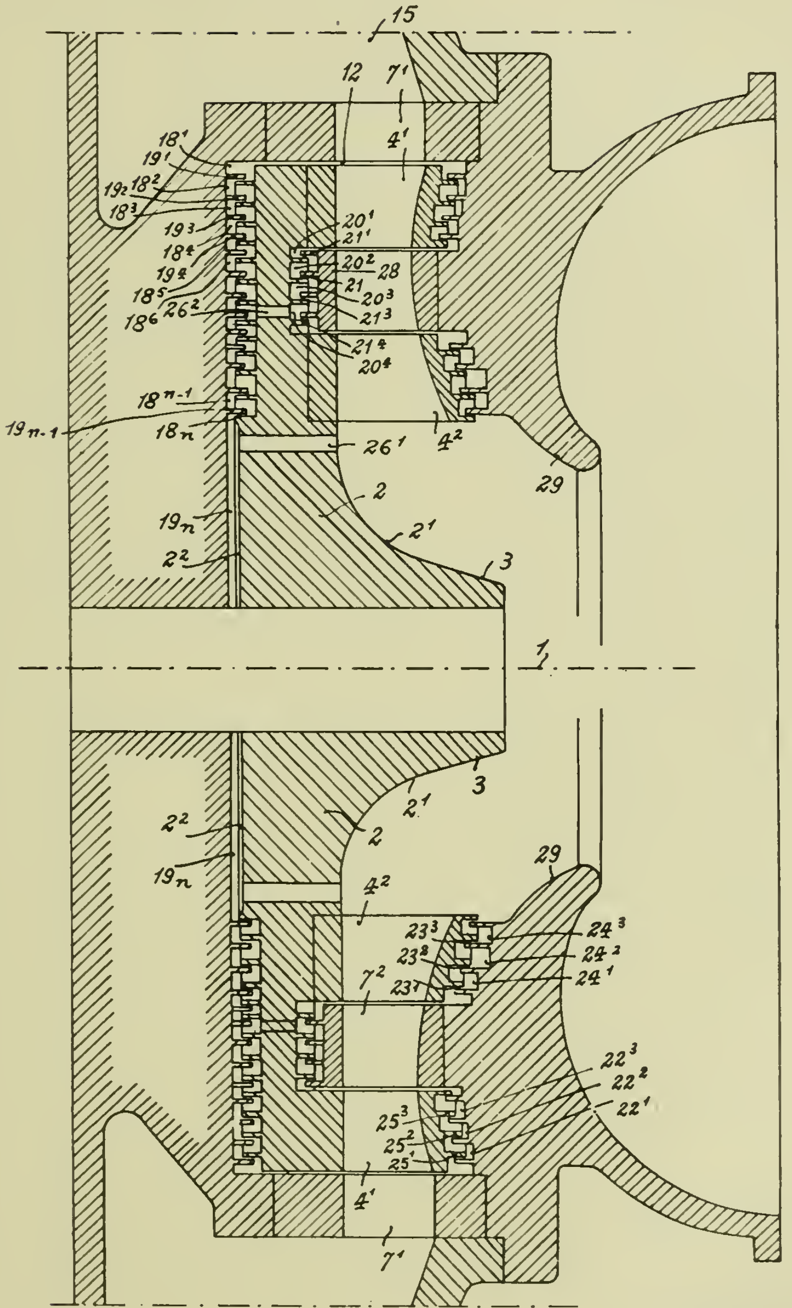

Fig. 5

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Published June 8, 1943 Serial No. 415,874

ALIEN PROPERTY CUSTODIAN

DEVICE FOR PEDALLING BY TWO PERSONS SPECIALLY ADAPTABLE TO BICYCLES

Georges Henriques Raba and Alice Henriques Raba, Sanary, France; vested in the Alien Property Custodian

Application filed October 21, 1941

The 2 seats bicycle, so called tandem, such as presently embodied, includes two similar seats placed one behind the other. The two cyclists occupy about the same length on the tandem, each of them using his own crankgear.

The result is a large and therefore bulky, heavy and costly machine which can hardly be managed by one person in the absence of the other.

The object of the present invention is to remove such drawbacks by creating a two-seats bicycle no larger than any ordinary bicycle and on which the two cyclists, still seated one behind the other but very close to each other and so to speak fitting into each other (rather like, on a motor-bicycle, the driver and his passenger on the tan-sad) both contribute to the pedalling, generally on the same crankgear, provided for instance and to that object with pedals allowing two feet to rest at the same time, such as further described.

In order to make the invention better understood, we shall now describe, as an instance in no way limitative, a few embodiments of the improvements it conveys.

Fig. I represents the two cyclists 1 and 2 as seated one on an ordinary saddle 3, the other on a seat with its back 4 allowing him to take support with his back, in order to react to the stroke of the pedal, as happens for cyclists using bicycles with horizontal pedalling. Such a seat, fixed where a luggage-carrier should be, can be provided with a strap so as to hold the second cyclist and prevent his sliding forwards.

The two cyclists, the legs of one more wide open and framing the other's legs, work the same crank gears 5 by means of the two elements pedals 6' 6 and 7' 7 of which Fig. II, still given as an instance, shows an embodiment.

These pedals, such as it looks, are simply common double pedals, two pedals successively fitted upon the same axle. The second element in each pedal may, if needed, be removable, unscrewed and folded back under the first in order to lessen the bulk in width of the machine when used by one person.

In another embodiment, both cyclists seated as aforesaid, no longer put their feet one besides the other respectively, but one above the other, with feet superposed on each other. The two elements 6 and 7 of the double pedal as well as 6' and 7' (Fig. III) are for instance assembled by small connecting-rods. The rotation of such connecting-rods around their upper axle is, if needed limited, although allowing of a satisfactory articulation of the ankles, in order to prevent the cyclist seating lower, from having his feet squeezed between the two elements of each pedal during their rotation.

A machine according to the invention may also be obtained by the alteration of any ordinary bicycle of strong build. And, considering the large number of bicycles in use at present, the adaptation of the invention to these will make in itself a far-reaching application.

As regards that simplest of alterations, it is enough to fix a seat where a luggage carrier should be while moving the saddle forwards, if needed, to balance the machine satisfactorily, and to substitute to the pedal other pedals such as have been already described, for instance.

The original pedals may be kept too, and the second element of pedals added, or more simply some kinds of foot-rests, which in a sort of embodiment, would make for instance a prolongation and allow the second cyclist to carry his effort. In order that such an effort may be performed normally, these foot rests should be displaced in relation to the plane of the pedals and show, if needed, a certain bent to account for the angle made by the two cyclists' legs and resulting from their respective position.

Fig. IV shows a device of such kind: 10 is a joint holding the existing pedal from underneath, and fastened to it by bolts 11. This joint is prolonged in order to make the rest foot 12 which the second cyclist will work. The rest foot, padded with rubber so as to prevent any sliding, shows an oval section and the plane of the main axle of the oval makes with the plane of the pedal an angle equivalent to that made by the two cyclists' legs.

A particularly simple embodiment as regards the system of adaptation can be devised as follows:

The pedal used by the second cyclist will consist of a U shaped stirrup 13, Fig. 5, of a length twice that of the pedal itself so as to project outwardly.

It will be fixed astride on the pedal, one of its two branches taking support from over the foreside of the pedal, the other from underneath against the back side of the pedal.

Rings 14 will be strong on each branch and hold it in the right place and will themselves be fixed against the sides of the pedals by means of small bolts.

According to this device, the plane of the stirrup makes with the plane of the pedal an angle

which successfully corresponds to the angle made by the two cyclists, with the crankgear as apex.

In order to compensate the angle made by a wider opening of the back cyclist's legs, the stirrup will be upwardly bent in its projecting part, as on Fig. V.

Finally, in another embodiment of the present invention which would only be advisable when the passenger on the back seat should be smaller and therefore have shorter legs than the driver's, the machine should be provided with two crankgears, both cogged as in a tandem. But the double crankgear, the sole object of which would be to correct the different size of the cyclist without lengthening the machine, should not modify their respective positions in relation to the invention, that is very close to each other. The two axles of the double crankgear should only be distant by the length needed by the cranks not to collide into each other, altogether allowing them to run courses overriding each other partially.

It is obvious that the above described machines can be equipped with all accessories as are usually fitted on bicycles or which may be adapted to them.

It is obvious that the above described machines can be equipped with all accessories as are usually fitted on bicycles or which may be adapted to them.

It should be noticed too that by means of that device, the efficient angle of action of each cyclist is displaced in relation to the other. The wholly dead angle is therefore reduced, allowing of an improved efficiency, particularly noticeable at reduced speed and when ascending hill.

The result is that the device double pedalling. such as above described, as applied to bicycles, can be adapted with profit to all machines actioned by pedals as on the bicycles: pedal boats, bellows actioned by pedals etc. and also to tandems which can therefore be used by 3 or 4 cyclists.

It further allows to create machines of a new kind endowed with the benefits of the invention: less bulk and less cost, or else to modifv the existing machines as would require increased power by the adjunction of accessories, a seat and double pedals, altering them according to the invention.

The shapes, sizes and devices of the framework and crankgear can vary, without modifying the general conception of the invention as above described.

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BY A. P. C.

G. H. RABA ET AL
DEVICE FOR PEDALLING BY TWO
PERSONS SPECIALLY ADAPTABLE
TO BICYCLES
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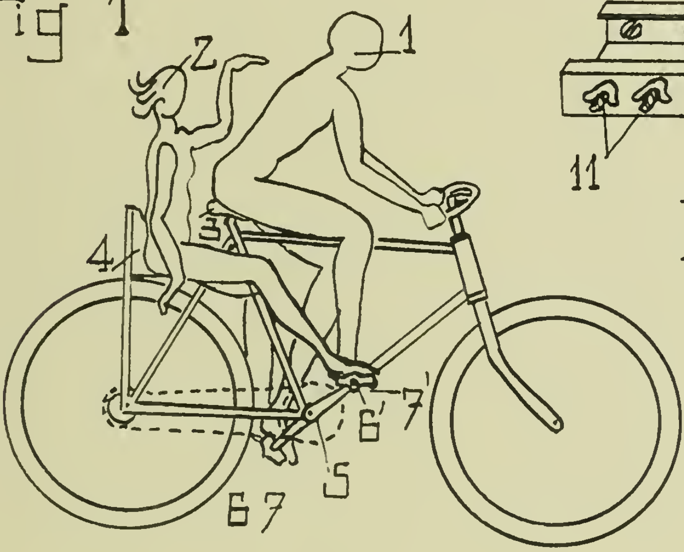
Fig 1



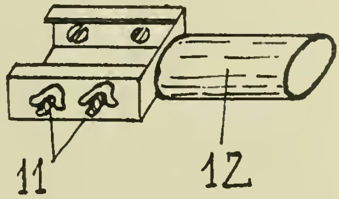
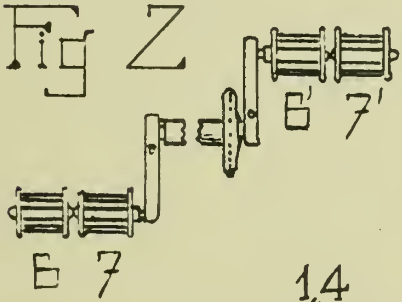


Fig 4

Fig 2



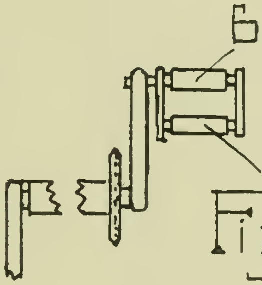


Fig 3

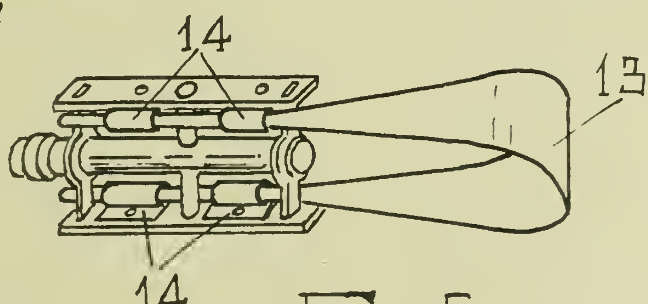


Fig 5

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ALIEN PROPERTY CUSTODIAN

AUTOMATIC WEIGHING MACHINES

Vladimír Dimitrijevič Popov, Prague-Bubenec, Bohemia and Moravia; vested in the Alien Property Custodian

Application filed October 21, 1941

This is a division of my prior application Serial Number 167,659 filed October 6, 1937.

The scale beams adopted in automatic weighing machines hitherto known are for the purpose of determining whether the weight of a given article, or of a given quantity of a material, is greater or less than a predetermined theoretical value, in order to enable a further operation to be effected in accordance with such determination. Thus for example the scale beams in machines for weighing out materials determine the weight of material upon the scale pan, and if the weight of material thereon is less than a pre-determined value, a further supply of material enters the scale pan, whereas in the event of there being a sufficient weight of material upon the pan this quantity is transferred for packing. Apparatus of this nature is disclosed U. S. Patent Number 2,198,788. In machines for sorting articles according to their weight the scale beams have the same function as in these weighing out machines, that is to say, of distributing the articles in accordance with any desired theoretical limit of weight, which may be determined in grams for example, into light and heavy articles.

For the correct sorting of articles into light and heavy articles it is very important that the scale beams should be of the utmost possible sensitiveness, and that this sensitiveness should in fact be utilized in weighing. The adoption of scale beams of the utmost sensitiveness, in known machines, does not however guarantee accurate working thereof, because the scale beams in automatic weighing are exposed to unfavourable conditions, which distort the normal working thereof, and prevent the weighing from being effected within the limits of sensitiveness of the scale beam. In some machines, for example, the scale beams are subjected during the weighing to the influence of individual accessory members, which, during the time when material is being supplied for weighing, have a braking effect on the action thereof, the deflection of the scale beam being utilised for carrying out operations which render it necessary that the deflection should be large and powerful. Finally in some machines the scale beams move upon an endless track or the like, which in itself precludes the employment of sensitive scale beams. In these cases, however, a mechanical impulse cannot be ensured in deflections within the limits of the sensitiveness of the scale beam.

Similar circumstances preclude the possibility of weighing upon scales, particularly automatic scales, with a maximum exactitude, that is to say, within the limits of very small weights, by which the sensitiveness of a scale beam is characterised. It should be mentioned that a scale beam in the position of equilibrium has no kinetic energy, and, that a very small loading of the scale beam, in the neighbourhood of the sensitiveness of the scale beam, yields a greatly retarded, small and hardly appreciable deflection, which cannot do any mechanical work, or even close the contact of an electric circuit, whereas in all automatic weighing apparatus, if the same are to work accurately, even with small deflections, in dependence upon the result of the weighing, an impulse must be given for the purpose of carrying out a mechanical operation; thus for example, for the purpose of delivering or not delivering material, or for the purpose of displacing the article in the direction of the light or heavy groups and so forth.

This invention consists in apparatus for automatic weighing by the aid of a scale beam, which, however, in its work is not exposed to any influence from subsidiary members, though in dependence upon the direction of deflection of the scale beam a mechanical impulse is obtained for producing a working effect upon the article. According to the present invention any deflections, even those that are hardly perceptible, can be ascertained, and are completely sufficient, after the termination of the weighing, in dependence upon the result thereof, to give a mechanical impulse, by means of an auxiliary source of energy, for the purpose of carrying out a further mechanical operation without any cooperation of the scale beam.

The apparatus according to this invention is based upon the mutual action of a part on the scale beam, and a special feeling number, which only comes into operation after the weighing has been effected or after any deflection of the scale beam.

A further important feature of the invention consists in a supplemental arresting device which ensures correct deflection of the scale beam and proper cooperation between the scale beam and feeler.

Some embodiments of weighing apparatus according to the present invention are diagrammatically illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a diagrammatic view in elevation of apparatus for carrying out the invention;

Figures 2, 3, 4 and 5 are similar views of part of the apparatus, showing various possible posi-

tions of the scale beam after the expiration of the time allowed for weighing;

Figure 7 shows a part of the apparatus shown in Figure 1 in a different position to illustrate the release of the scale beam, and

Figures 8 to 12 are various views showing a further modified form of construction.

Figure 1 shows ordinary weighing apparatus with a two-armed scale beam 1, which swings upon the knife edge of a triangular knife 2 on bearing 3. At the ends of the scale beam 1 there are triangular knife edges 4 and 5, through the medium of which loads P and Q to be compared act upon the scale beam 1. The scale beam 1 may be held at the points m and n by means of any known arresting device acting in the direction of movement of the scale beam and, forming, for instance, a fork 6, which is supported by means of a roller 7 upon one arm of a lever 8, which can be deflected into the position indicated in dotted lines in Figure 1 by the co-operation of a cam disc 9 with a roller 10. The lever 8 executes such a deflection when the cam disc 9 revolves in the direction indicated by an arrow, when the point b of the cam disc comes into contact with the roller 10. The roller 7, and with it the fork 6, then sink into the position indicated in dotted lines in Figure 1, and remain in this position during the further rotation of the cam disc 9, until the point c thereon comes into contact with the roller 10. In the lower position of the arresting fork 6 the scale beam 1 is completely released, and can oscillate under the influence of the loads P and Q. The time during which the part from b to c of the periphery of the cam disc 9 is passing the roller 10 is therefore devoted to the weighing. During the further rotation of the cam disc 9 through an angle corresponding to the part c to d the lever 8 rocks back into the original position and arrests the scale beam 1 for a period during which the cam disc 9 rotates from d through e and f to a. Hence the scale beam, from the point d to the point a of the cam disc 9, is arrested, and during this time, by means of a known device, the load P or Q can be removed and replaced by a fresh one, or some other work can be carried out in dependence upon the purpose for which the weighing machine is employed.

The scale beam may for instance be sensitive to a loading of 0.01 gram, and from this load upwards is capable of deflecting from the position AB into the position CD or EF within the time during which the cam disc 9 passes with its arc b—c over the roller 10. This period is hereinafter referred to as the weighing time.

In order to determine this deflection upwards or downwards, and to give a corresponding impulse for carrying out or not carrying out a definite operation by means of an auxiliary source of energy, there is employed according to the invention an operation control means consisting for example of a member 12 bent into the shape of a hook with one sharp end and one blunt end (Fig. 6) mounted on the end of a lever 11. This hook, which will hereinafter be referred to as the feeler can rotate freely in the lever 11 in a counter clockwise direction according to the embodiment illustrated about a pivot 12*a* (Figure 6), while rotation thereof in a clockwise direction is prevented by an abutment or screw 13, upon which the blunt horizontal end 12*b* of the feeler 12 rests by its own weight. The lever 11 swings upon a pivot 14 by the aid of a cam disc 15 (Figure 1) revolving at the same time as the disc 9 about the same axis, and of a roller 16. Within the time during which the segment a—b—c of the cam disc 9 is moving past the roller 10, a segment a_1—b_1—c_1 of the cam disc 15 moves past the roller 16, and the lever 11 is deflected through an angle α_0 so that in the position corresponding to the point c_1 on the cam disc 15 the lever 11, with its feeler 12 touches a part arranged rockably on the end of the scale beam. In the example shown, the said part is formed by a blade-like contact member 17 which bears freely upon a small table 18 secured to the end of the scale beam 1 and provided with a notch 19. The part 17 bears with one knife edge against the edge of the table 18, and projects with its other knife edge beyond the margin of this table. The correct position of the plate 17 upon the table 18 is ensured by its own weight.

In the event of the scale beam 1, in consequence of a difference between the loads Q and P amount to 0.01 gram or more, moving out of the position AB into the position EF when released, the aforementioned contact of the feeler 12 with the edge of the part 17 does not take place, and since the lever 11, owing to the influence of the cam surface c_1—d_1 on the cam disc deflects further through an angle α, the feeler 12 passes undisturbed through the notch 19 in the table 18 underneath the part 17, as shown in Figure 3. In the event of the scale beam 1, in consequence of the difference between P and Q being equal to or greater than 0.01 gram, being deflected to the left into the position CD, the feeler 12, upon the lever 11 being deflected through the angle $\alpha_0+\alpha$, engages the edge of the part 17 and is rotated in a counter clockwise direction relative to the lever 11, as shown in Figure 4. If actual contact of the point of the feeler 12 with the edge of the part 17 occurs, which is only possible when the scale beam 1 is at rest in its position AB, that is, for instance, when $P-Q$ is less than 0.01 gram, the feeler 12, upon deflection of the lever 11 through the angle $\alpha_0+\alpha$, rotates in a counter clockwise direction, and can also raise the part 17, as shown in Figure 5. The position of the feeler 12 corresponding to Figure 5 is very improbable, since during the raising of the part 17 the equilibrium at the point of contact is disturbed, and the part 17 in relation to the feeler 12, assumes one of the positions represented in Figures 3 and 4.

From the above description it will be gathered that the lever 11 has a positive movement, and takes the feeler 12 with it towards the scale beam, so that if the part 17 were to be rigidly connected with the scale beam 1, the feeler 12, in the event of direct contact with the part 17, would have to bear against the part, and a raising of the scale beam out of its bearing 3 might occur. To prevent this, the movability of the part 17 is necessary.

It is obvious from Figure 3 that, for instance, with a load P less than Q, the feeler 12 deflects freely through the entire angle $\alpha_0+\alpha$ without meeting the part 17 and bears with its blunt end 12*b* against the lever 21. This lever 21 serves as release organ, whose movement may be utilized for operating a known mechanism which carries out certain manipulations with the article on the scale, for instance, it removes said article and puts a fresh one in its place, or it carries out other manipulations which are dependent on the purpose for which the scale beam is intended. It is also possible to utilize the movement of the lever or release organ 21, for instance, through the medium of a contact spring 22 for switching

on an electric current of any known device (not shown) which carries out the corresponding manipulations with the article. The lever or the release organ **21** normally assumes the position shown in Figure 1; this position is determined, for instance, by a regulating screw **21***a* (Fig. 1) arranged on the left arm of the lever **21**. The said regulating screw **21***a* prevents a deflection of the lever **21** to the left while a deflection to the right is effected by the blunt end **12***b* of the feeler **12** bearing against the said lever so that this lever is moved to the right (Fig. 3) and comes in contact with the contact spring **22** which, as stated above, is adapted to switch on an electromagnetic device. When the feeler **12** meets the part **17**, as shown in Fig. 4, the end of the feeler **12***b* moves upward whereby it does not meet the lever or release organ **21**, that is to say the release organ **21** is not actuated so that the corresponding mechanism is not set in operation.

As regards the case illustrated in Figure 5, the arm **12***b* likewise cannot rock the lever **21** for the purpose of giving contact with the spring **22**, and the article is automatically transferred to the category of heavy articles. If however the position of the feeler **12** after contact with the part **17** is changed into the position illustrated in Figure 3, the article is transferred into the category of light articles. On this ground in the event of the weight of the article differing from a predetermined theoretical value by an amount smaller than that by which the sensitiveness of the scale beam is characterised, for instance 0.01 gram, or in other words if the scale beam executes no deflection, a transfer of the article into the category of heavy articles is possible in the same manner as the transfer thereof into the category of light articles, because its weight lies at the theoretical boundary between the two categories. Articles of a weight which differs from a pre-determined theoretical value by a magnitude characterising the sensitiveness of the scale beam, for instance by 0.01 gram, or by a greater value, are transferred to the corresponding category. From the point d_1 on the cam disc **15** onwards, the lever **11**, together with the feeler **12**, owing to the action of the cam d_1—e_1—f_1—a_1, can execute a return movement into the original position (Figure 1), that is, within the time in which the scale beam can already be arrested, as will be seen from the cam disc **9** in Figure 1, for the purpose of effecting, during the time of its arrest, any desired operation on the article weighed, for which purpose an impulse has been given by the lever **21**.

It may be observed that the part **17**, as already described, is rockable on the scale beam **1**, that is to say, can raise itself, as indicated in Figure 5. Such a construction of the part **17** is for the purpose, as already mentioned, of preventing the knife edge **2** from being displaced relatively to or raised out of its bearing **3**, at the moment of contact of the part **17** with the feeler **12**. This measure is indispensable if the sensitiveness of the scale beam **1** is to be preserved.

The feeling means described can only work accurately under the condition that the deflection of the scale beam immediately following the moment of release of the scale beam by the stop occurs on the right side, that is, on the side of the greater load, P or Q. Not one of the known arresting devices all of which act in the direction of the deflections of the scale beam can however ensure such regularity of the deflection of the scale beam, because on account of moisture, dirt or other hitherto undiscovered causes the scale beam adheres to the arresting members, and is practically never released at the two points *m* and *n* at exactly the same moment. Such a phenomenon can as a rule be observed in the manually controlled balances in chemical laboratories, and for this reason the first deflection is always ignored therein, and the weight of the article is judged by observing a number of successive deflections, or is noted after the scale beam has come to rest. These circumstances have the result that after releasing the arrest, the scale beam does not remain at rest, either when there is complete equality between P and Q or when there is a slight difference between them, but can oscillate to one side or the other, so that the feeler may yield an inaccurate weighing result, and may therefore occasion an error in the action of the machine. If for instance on the left arm of the scale beam **1** in Figure 1 the load P is lighter than the load Q by 0.01 gram, the scale beam should adjust itself into the position EF. In consequence however of adhesion of the scale beam at the point *m* to the arresting fork **6**, the scale beam may swing, after release, out of the position AB into the position CD. If this incorrect deflection occurs at a time when the arc *b*—*c* of the cam disc **9** is acting upon the roller **10** it is obvious that an article, which in itself is light, may be disposed of as if it were a heavy article.

The suitability of the feeler is therefore conditioned by a correct direction of the first deflection of the scale beam, which according to the present invention is attained by means of a secondary arresting device, which is illustrated in Figures 1 and 7, and which consists for example of a three-armed lever freely rotatable upon the pivot **24**. The arm **23** of the three-armed lever is pressed lightly against the point of a pin **26**, secured to the scale beam **1**, by the influence of a weight **25** loading the three-armed lever. After release by the primary arresting device **6** the scale beam still remains under the influence of the three-armed lever, which, by friction of the arm **23** on the point of the pin **26**, reduces the sensitiveness of the scale beam for a time, for instance for so long as the point *b* on the cam disc **9** is not in contact with the roller **10**, so that the aforementioned adhesion at the points *m* and *n* by the scale beam is not perceptible, and therefore does not bring about any deflection of the scale beam at the wrong time. As soon as the arresting fork **6** assumes its lower position, indicated in Figure 7, and in Figure 1 in dotted lines, which occurs at the point *b* of the cam disc **9** (Figures 1 and 13), a stoppage of the secondary arresting appliance is effected, this being by the aid of a lever **27**, rotatable upon a pivot **28**, and resting upon the lever arm **8**. An upwardly directed arm **27***a* of this lever strikes against a downwardly directed arm **23***a* of the three-armed lever **23** and rocks the same in a clockwise direction, as a result of which the arm **23** of this three-armed lever releases the pin **26**, and therefore the scale beam **1** also, wherein any movement occurs with zero velocity exclusively under the influence of the loads P and Q. The moment of release of the scale beam by the secondary arresting device therefore constitutes the beginning of the weighing, that is, at the point *b* on the cam disc **9**. The end of the weighing occurs at the moment at which the feeler **12** touches the edge of the blade **17** or travels beyond the said angle.

It is quite clear that with a sufficiently large difference between the loads P and Q, regardless of the adhesion of the scale beam at the points m and n, the first deflection of the scale beam will always be in the right direction, and may take place even before the stoppage of the secondary arresting device. In the case of small difference between P and Q, and the adhesion phenomena at the points m and n, the correctness of the scale beam deflection is ensured by the employment of the secondary arresting device **23** described. For a scale beam of very high sensitiveness, particularly a scale beam for weighing small doses or light articles, another embodiment of the device described is provided by the present invention, wherein the action of the feeler **12** upon the part **17** and the action of the secondary arresting device **23** upon a supporting member are opposite in direction to the action of gravity upon the scale beam **1** itself.

These devices, and the manner in which they co-operate, are diagrammatically illustrated in Figures 8 and 9, in which the parts serving the same purpose as those of Figures 1 and 13 are denoted by the same references, which are however distinguished by the index **1**. Thus for example the part **17** of Figures 1 to 7 is denoted in Figures 8 and 9 by the reference $\mathbf{17^1}$. The part $\mathbf{17^1}$ of Figures 8 and 9, provided at its lower end with a knife edge, is rotatably supported upon a pivot **29** on a holder $\mathbf{18^1}$ secured to the scale beam **1**. The duty of the pin **26** of Figures 1 and 7 is here allocated, in Figures 8 and 9, to a tongue $\mathbf{26^1}$, against the lower end of which a secondary arresting lever $\mathbf{23^1}$ bears under the action of a weight $\mathbf{25^1}$, and thereby damps out undesirable deflections of the scale beam, which arise at the points m and n upon release by the primary arresting fork $\mathbf{6^1}$ by means of the lever $\mathbf{8^1}$ and the cam disc $\mathbf{9^1}$. The secondary arresting lever $\mathbf{23^1}$ sets free the scale beam **1** owing to the fact that a pin $\mathbf{27^1}$ secured to the fork $\mathbf{6^1}$, when the fork $\mathbf{6^1}$ descends, brings the lever $\mathbf{23^1}$ from the lower end of the tongue $\mathbf{26^1}$ into the position represented in Figure 9. The method of action of the feeler needle $\mathbf{12^1}$, which is rotatable on a lever $\mathbf{11^1}$ deflecting by the action of the cam disc $\mathbf{15^1}$ in an angle $\alpha_0+\alpha$ and maintained in its position by a screw $\mathbf{13^1}$ for example, is completely analogous to the action of the feeler **12** of Figures 1 to 6. In Figure 10 a position is represented in which the scale beam, by the action of the loads P and Q, together with the part $\mathbf{17^1}$, is deflected in a counterclockwise direction, so that the feeler $\mathbf{12^1}$, upon the lever $\mathbf{11^1}$ being deflected through the angle $\alpha_0+\alpha$, deflects freely in the same manner as in Figure 3, and acts by its end $\mathbf{12}b^1$ upon the lever $\mathbf{21^1}$, which touches a contact spring $\mathbf{22^1}$ for example. Figure 11 shows a case in which the scale beam **1** is deflected in a direction opposite to that of Figure 10, so that the part $\mathbf{17^1}$, with its lower end, places itself in the way of the feeler $\mathbf{12^1}$, which changes its position in relation to the lever $\mathbf{11^1}$, and does not influence the lever $\mathbf{21^1}$ by its end $\mathbf{12}b^1$. Finally, in Figure 12, an unstable position of the feeler $\mathbf{12^1}$ in relation to the part $\mathbf{17^1}$ is represented, which may change with equal probability into either of the two positions mentioned (Figures 10 and 11), and which corresponds to the positions represented in Figure 5 of the first embodiment.

The appliances described, therefore, are for the purpose of providing for accurate automatic weighing on a scale beam, for the purpose of sorting articles according to their weight, or adding material in relatively light doses, as in U. S. Patent No. 2,198,788.

By the co-operation of scale beam, **1**, a secondary arresting device **23** and a needle like feeler **12**, the problem is solved of obtaining, by means of a secondary source of energy, for instance by means of an oscillating or other movement of the lever **11** together with the feeler **12**, an impulse for carrying out mechanical operations which are required for the operation of automatic weighing machines. The scale beam is herein exposed to no subsidiary influences during the period of the weighing, and therefore accomplishes merely its own purpose, namely the weighing, and does no work directly by its own deflection, so that the sensitiveness of the same is fully utilised. The impulse for carrying out or not carrying out a mechanical operation is given in reality by the indicator member, which determines, at a pre-determined moment after the weighing, the condition of the scale beam, that is to say the position of the scale beam at this instant, and gives or refrains from giving a mechanical impulse in dependence upon the said position.

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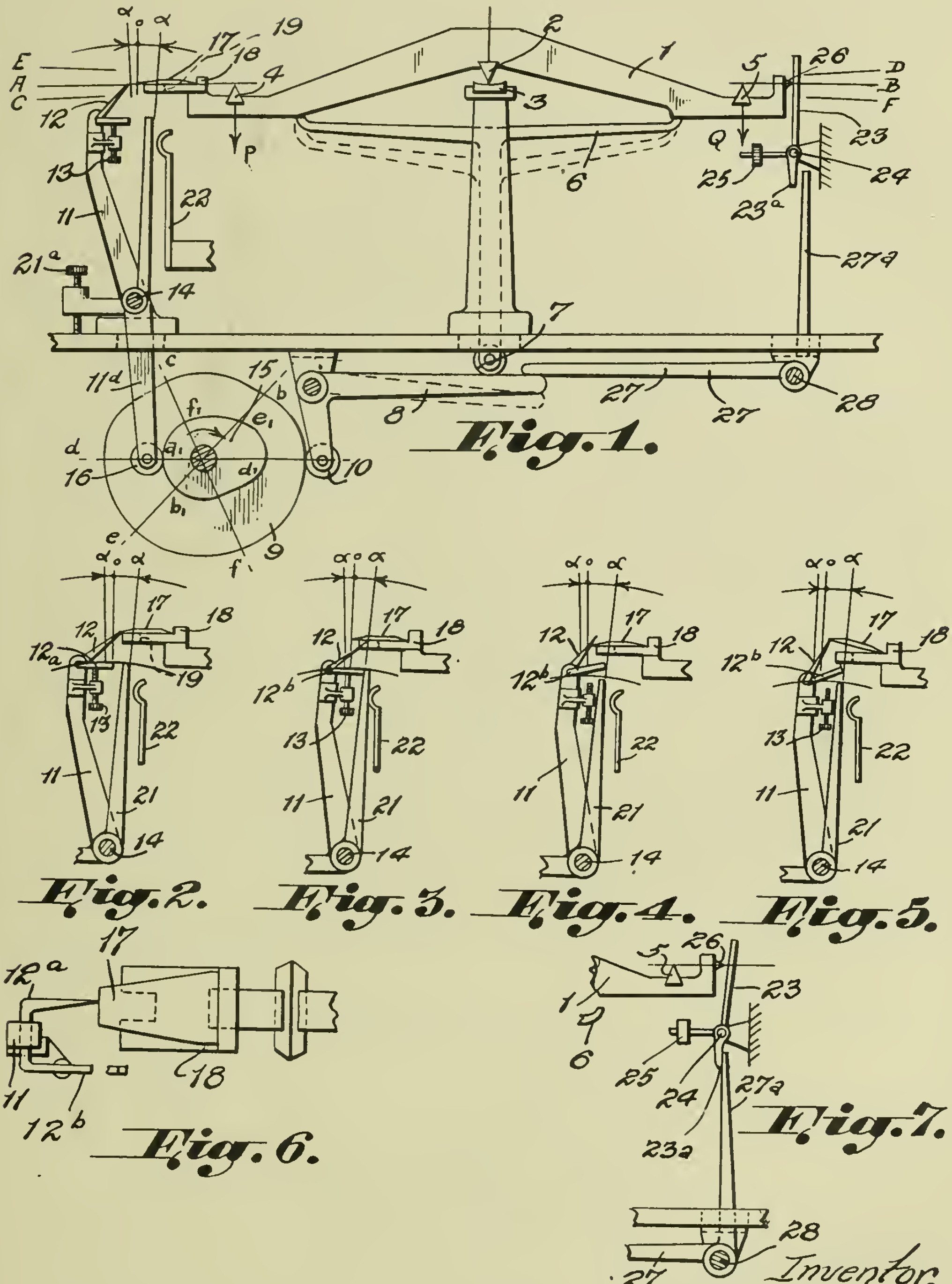
V. D. POPOV
AUTOMATIC WEIGHING MACHINES
Original Filed Oct. 6, 1937

Serial No. 415,981
2 Sheets-Sheet 1



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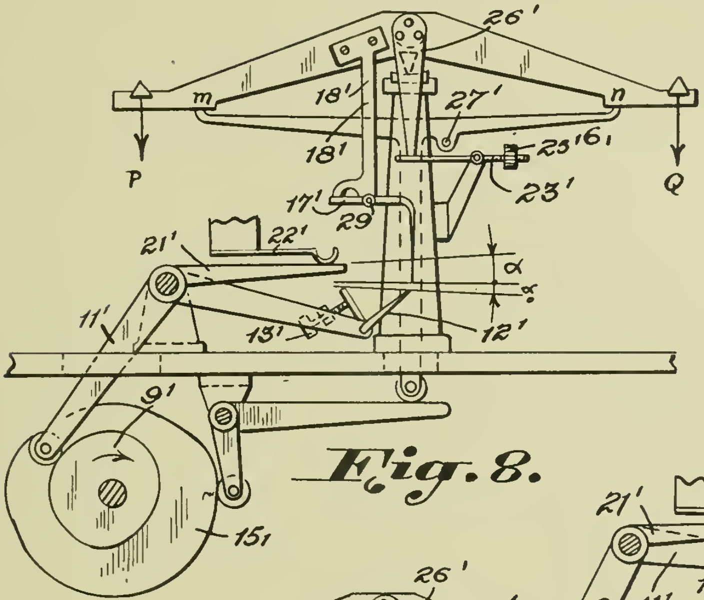

Fig. 8.

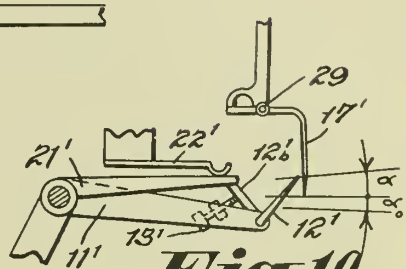

Fig. 10.

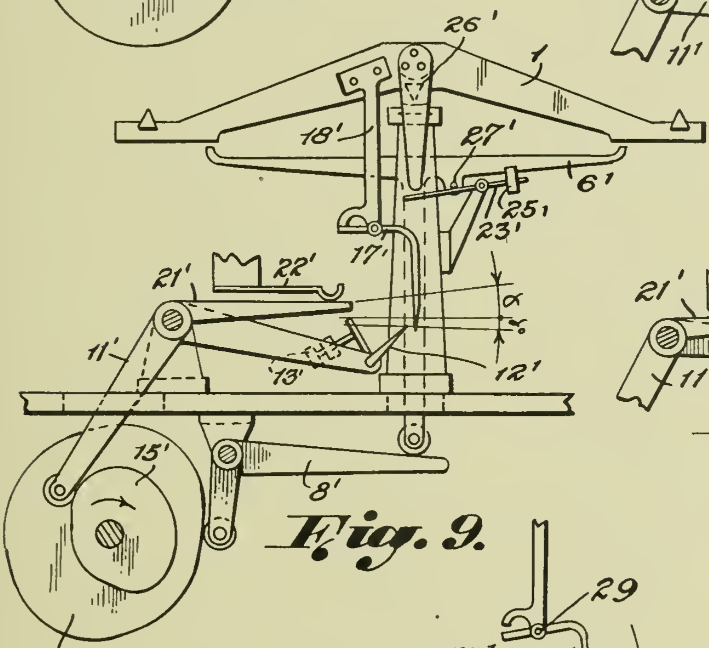

Fig. 9.

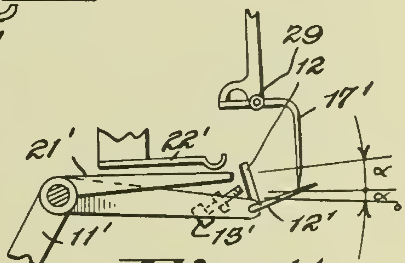

Fig. 11.

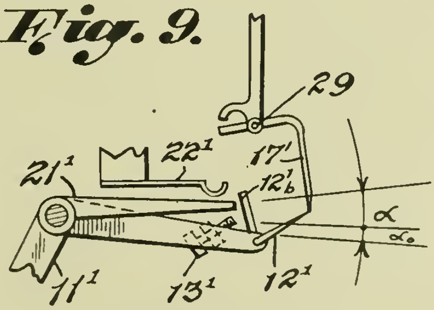

Fig. 12.

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ALIEN PROPERTY CUSTODIAN

SYSTEM OF RADIO COMMUNICATIONS

Berko Tenenbaum, Lyons, France; vested in the Alien Property Custodian

Application filed November 3, 1941

The present invention refers to the existing systems of radio communications, and in particular to a system supplying the means of suppressing certain defects in receivers generally utilized and known under the name of superheterodyne receivers, or receivers based on the principle of frequency conversion.

These defects appear especially when receiving short and ultra short wave signals. Namely:

1. *The defects of frequency changes.*—This effect is due to the accidental changes in the supply voltage, variations in the temperature of tubes, reactions of exterior circuits, mechanical vibrations, etc. These phenomena influencing the frequency of the local oscillator, augment with the increase of the frequency of reception and prevent the realisation of stable or automatic communications.

2. *Difficulties of accurate tuning.*—This defect of manipulation in superheterodyne receivers is due to the great selectivity of these receivers. The difficulties increase with the frequency of reception, and in the case of short waves limit the possibilities of selectivity which can be imposed to the receivers. This brings about a reduction of the number of net work systems for a band of frequency.

3. The ratio noise/signal increases with the sensibility of the receivers, which diminishes the possible efficacity of the superheterodyne receivers. The principal reason of this defect is due to the irregularity of the local oscillations of these receivers.

The present invention offers an improvement, permitting the elimination or at least the reduction of the stipulated defects.

Above this, beginning with this improvement, it has for object a system of communications remaining secret, and having the advantage of being undetectable by third parties.

Rules

The formula of frequency conversion is as follows:

$$Fs=Fo\pm Fif$$

or

Fs is the frequency of the signal to be received.

Fo is the frequency of the local oscillator.

Fif is the frequency of tuning of intermediate frequency transformers.

The usual method consisted in making Fif a fixed frequency (generally in the region of 100 to 500 Kc. or around 1600 Kc. for short waves) and for the reception of a signal of Fs frequency, the adjustment in the frequency of the local oscillator on Fo.

This method carries with it the inconveniences cited in Paragraphs 1, 2, 3.

Our method consists in rendering absolutely fixed the frequency of the oscillations of the local heterodyne Fo stabilizing them by a piezo-electric crystal, and for a signal to be received of frequency Fs, to vary (e. g. by variable condensers) the tuning of transformers of intermediate frequency until their circuits are adjusted on Fif.

The diagrammatical principle of this method is given on Fig. 1.

The tube **2** serves as local heterodyne where oscillations are engendered by a crystal **4** of frequency Fo inserted for example in the grid **15** circuit. These oscillations are injected through the condensers **18'** in one of the grids **12** of the mixer tube **1**, whose control grid **13** is attacked by the signal to be received of frequency Fs through the input circuit **5**. In the plate circuit of this mixer tube is found the primary of the transformer of intermediate frequency **6**, the secondary **7** being (or the primary and the secondary) one tunes by a variable condenser **8**, on a frequency Fif so that:

$$Fif=Fs-Fo$$

in supposing that one uses a frequency inferior to the heterodyne.

The tube **3** forms the intermediate frequency amplificator and possesses in its plate circuit an intermediate frequency transformer (identical to the first) **9** and **10**, and on which is adjusted also on Fif the secondary (or the primary and the secondary) by the variable condenser **11**. These two condensers can be ganged.

Various scales of reception can be obtained by employing a number of crystals, which are switched; one can also use for ultra-high frequencies of an harmonic of the oscillation engendered by a crystal.

Once tuned the organs **8** and **11** of adjustment of the intermediate transformers can be rendered fixed or blocked mechanically, allowing one to obtain through this, entirely automatic communications, on condition of having received transmissions stabilized in the same manner, i. e. by piezo-electric crystal.

The input circuit **5** being much deadened (especially in short waves) is easily adjustable.

The advantages of the system are as follows:

1. Complete suppression of frequency changes. The local heterodyne being stabilized by a crys-

tal, no variation of local frequency is to be feared, even for the highest frequencies.

This permits absolutely sound tuning precisely checked. One can establish too automatic communications with automatic tuning even for ultra high frequencies.

One may thus push the selectivity of the receiver up to limits which are technically possible and increase the number of net work systems for a band of frequency.

2. Possibilities of pushing the sensibility of receivers without notably increasing the ratio noise/signal.

The noise of the receivers stabilized by crystal, being diminished by the fact that the oscillations are supplied by a quartz.

Our method permits the establishment of a system of grids, of which the correspondents each own a transmitter with many frequencies of transmissions stabilized by crystals, brought successively into play by switches and a receiver with automatic tuning, possessing only a single frequency of reception defined by its quartz, inserted in the local heterodyne of the receiver.

The correspondents of this net work system can thus call and communicate automatically as in the telegraphic or telephone wire systems.

Another advantage of the system is that it is impossible for other correspondents of the net work system to tap messages transmitted; as it is only possible to receive them on a single and well defined frequency of reception.

Fig. 2 and Fig. 3 represent the principles of such transmission-reception with automatic tuning.

Tube **1** and Fig. 2 forms the crystal controlled oscillator of the transmitter with its tank circuit **10** in the plate **13** and whose oscillations are engendered by one or more piezo-electric quartz **2**, **3**, **4**, **5** mounted in the grid **12**; the quartz are brought into play by a switch represented in the diagram by **6**, **7**, **8**, **9**. An output circuit **11** excites the following stage.

Fig. 3 represents the principle of a receiver destined to receive with an automatic tuning one of the frequencies transmitted by the transmitter mounted as in Fig. 2. This receiver possesses a local oscillator formed by the tube **2** with a quartz **3** inserted in the circuit of the grid, and whose frequency equals lets us suppose Fo; the tank circuit **4** is in the plate and its oscillations are injected by the condenser **5** into the tube **1** forming the mixer; the control grid of this tube is attacked by the signal to be received of frequency which we shall call F*s* by the input circuit **6**.

In the plate **9** of the mixer is the tuned circuit **10** forming the primary of the intermediate frequency transformer, the circuit **11** forms the secondary; the circuits **13**, **14**, **15** present in the diagram the amplifier of the intermediate frequency the which if one wishes to obtain a very advanced selectivity, will be mounted with a quartz filter represented by **12**.

The tuning frequency of the intermediate frequency amplificator will be adjusted on a frequency F*if* so as to satisfy the formula:

$$Fif = Fs - Fo \text{ if } Fo < Fs$$

or

$$Fif = Fo - Fs \text{ if } Fo > Fs$$

Practically one can fix in advance F*if*, and choose the frequency of the quartz, by one of these two formulae, and adjust, once the receiver is mounted, the intermediate frequency transformers, on the oscillation which will result from the beat of the signal to be received F*s*, and the local signal Fo; the circuits **16**, **22** represent in the diagram the detecting and amplifying circuits of low frequency.

The tube **17** and the circuits **18** form a beat oscillator, so as to receive non modulated waves; **23** represents the phone.

The method of communication permits the establishment of a system of transmission and reception enabling one to keep the messages secret.

The transmitter will then contain a number of frequencies of transmissions each supplied by a piezo-electric quartz; these quartz will be brought successively and systematically into play by a special switch varying continually its contacts; each of the frequencies of transmission will serve then only for a small fraction of the message to be transmitted.

At the receiving station one will dispose of a number of superheterodyne receivers, equal to the number of transmission frequencies.

Each of these receivers will be of automatic tuning and stabilized by a crystal coupled with one of the crystals of the transmitter as in the principles described; in this way each of the receivers will automatically receive a portion of the message.

These different receivers will function simultaneously and will bring into action after having selected and detected the signals received a common phone. Thus at the reception will be obtained a complete message corresponding to that of the transmitter.

The essential diagrams of this method may be given by Figs. 2 and 3 previously used, we shall only dispose of at the transmission for the switch of a system with press buttons, similar to typewriter keys of which each key **6**, **7**, **8**, **9** corresponding to different transmission frequencies and will represent a code already agreed on. If one wishes to avoid having to switch the tuned circuits, one will fix these different frequencies very close to each other. These will be chosen in preference in the short wave bands.

At the reception one will dispose of a quantity of sets erected as Fig. 3, the number of these sets will be equal to the number of crystal contacts of the transmitter. Each of these receivers will be automatically tuned, through a quartz inserted in its local oscillator, and whose frequency will correspond to one of the frequencies of the transmitter.

These receivers who will function simultaneously, will select easily the different frequencies of the transmitter, thanks to the great selectivity which can be imposed on them in our system of reception.

This selectivity can be obtained e. g. by crystal filter **12** of intermediate frequency, as shown on Fig. 3.

So as to detect and differentiate the signals thus received by the various receivers, one can use the beat oscillator **17**. In fact by adjusting the variable condenser **19** one will obtain different sounds for each receiver.

These sounds will be picked up by a common phone **23**.

Thus for each push button of the transmitter one will obtain a different sound at the receiving station and thus "read" by the sound the transmitted message.

A communication established in this manner will keep the transmission secret. In effect to

receive and read it a third person will be obliged to know:

a. The different frequencies of the transmissions utilized.

b. The convention of the correspondents, concerning the signification of each of the frequencies transmitted.

It would be necessary as well, for them to dispose of a system of reception permitting them to select the signals received.

Another advantage of the system is that it is practically impossible to use a radiogonometer for a signal thus transmitted. This signal keeping a frequency determined only during a very short period.

Summary

The present patent offers an improved method of radio communications and consists of:

A. A reception system of radio electric signals, by applying the principles of frequency changes.

The receiver is erected in the following manner:

The frequency of the local oscillations of the receiver are rendered fixed, by stabilizing them with a piezo-electric crystal inserted in one of the circuits of the local heterodyne, the resonant circuits of the intermediate frequency transformers are tuned on the frequency resulting from the beat of the two oscillations: that of the signal to be received, and that of the local oscillator engendered by the crystal.

B. A transmission-reception system of automatic tuning consisting of:

a. A transmitter with one or more transmission frequencies, each stabilized by a piezo-electric crystal.

b. A receiver whose local oscillator is stabilized by one or more piezo-electric crystals whose frequencies are chosen in such a manner that the successive differences between the two frequencies; that of the transmission to be received and that of the local heterodyne are always equal to the frequency on which are adjusted the intermediate frequency transformers.

C. A method of transmission-reception enabling the transmitted messages to be kept secret and consisting of:

a. A transmitter possessing several transmission frequencies, each of which is stabilized by piezo-electric crystal and whose transmission varies systemmatically in wave length by a successive switching of stabilizing crystals; each of the transmission frequencies thus serves only for a small part of the message to be transmitted.

b. A reception system which permits the reception and selection of the signals thus transmitted, and consisting of a number of superheterodyne receivers equal to the number of transmission frequencies, and of which each possesses a local oscillator, stabilized by a piezo-electric crystal coupled with one of the transmitter crystals, according to the principles described in paragraph B of the present summary.

In this manner each of the receivers, receive automatically a part of the message transmitted; the different receivers functioning at the same time can bring into action the same phone, thus enabling the entire message to be obtained.

BERKO TENENBAUM.

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JUNE 8, 1943.
BY A. P. C.

B. TENENBAUM
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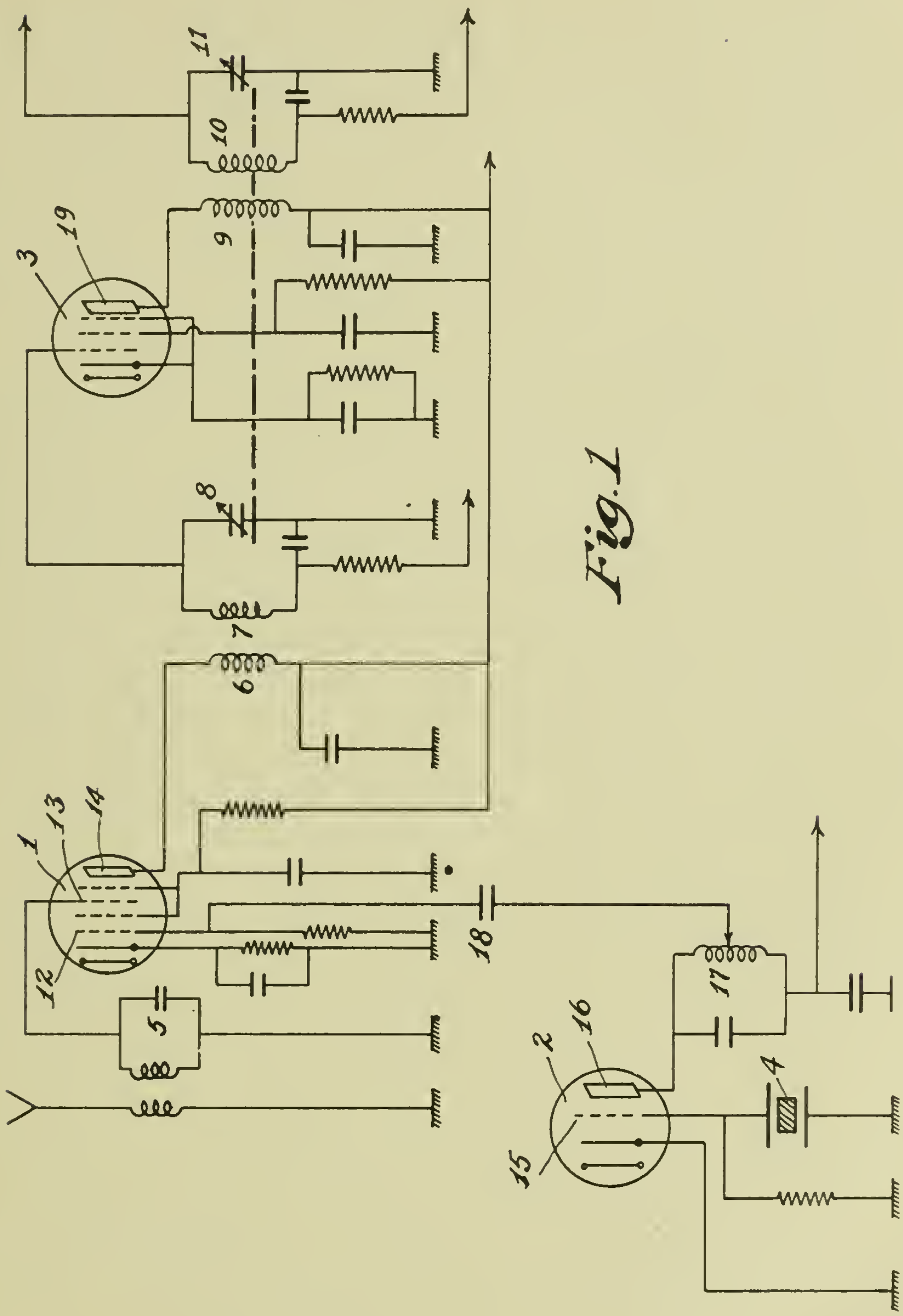

Fig. 1

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2 Sheets—Sheet 2

Fig. 3

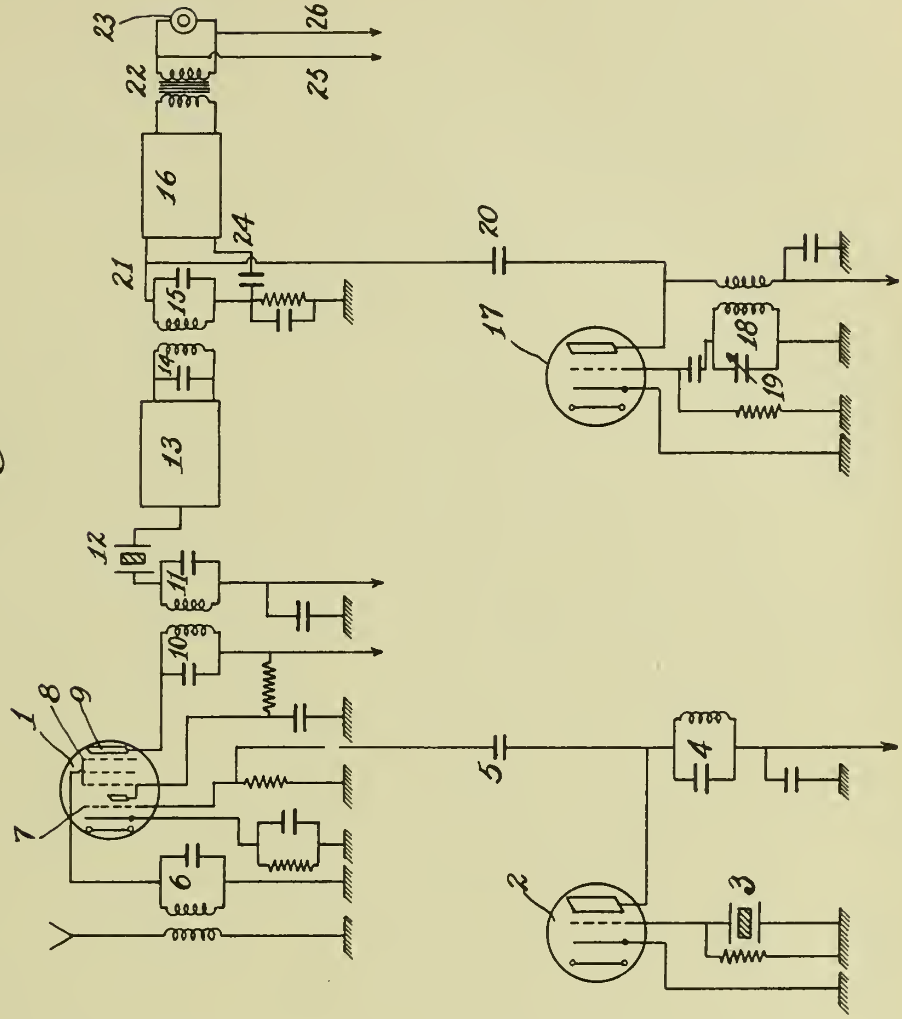
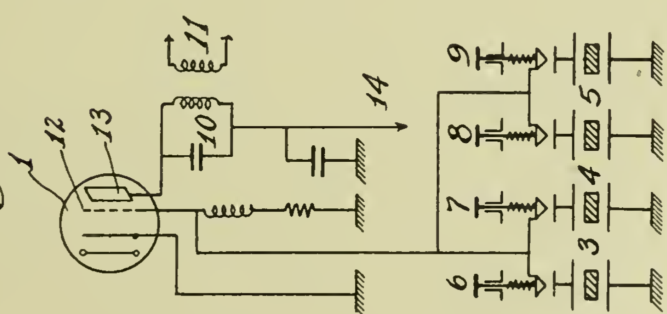


Fig. 2



INVENTOR,
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BY Benjamin Roman.

Published June 8, 1943 Serial No. 418,067

ALIEN PROPERTY CUSTODIAN

PRINTING COLORS AND A METHOD FOR MANUFACTURING THE SAME

André Henri Victor Durr, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed November 6, 1941

This invention relates to a method for the manufacture of printing colours, to the products resulting therefrom, and to their uses in the art.

In the specification of patent No. — — the applicant has described a method for the production of printing colours which essentially consists in grinding a siccative glycerophthalic rosin, after which the so obtained pigmented enamel is emulsified in water. Owing to the fact that the preparation of the emulsion takes place only after grinding of the pigment with a solution of the siccative glycerophthalic rosin, the pigment is perfectly coated with the latter, which results in giving decorative effects which are very fast and resistant to washing as well as to rubbing.

In the specification of patent No. — — a practical embodiment of the above mentioned method has been described which consists in effecting the grinding and emulsifying operations with such proportions of the substances used that the colour is obtained in the form of a concentrated paste suitable for being brought to the desired viscosity when it is to be utilized by the addition of diluents which do not destroy the emulsion. In the above mentioned patent No. — — the possibility of incorporating siccatives with the printing colour either in the course of the grinding operation or during the diluation of the colour has also been provided for.

The present invention relates to novel changes and improvements in the method according to patent No. — —.

According to one of the improvements which constitutes an object of the present invention, it has been found by Messrs. André Durr and Richard Gardedieu in the laboratories of the applicant that it was possible, by a judicious selection of the kind of rosin, to obtain printing colours which can be dried under the broadest conditions of time and temperature, while offering an excellent resistance to rubbing and soaping and more particularly to alkaline soaping under boiling conditions.

When printing with a colour formed by an emulsion in water of a pigmented glycerophthalic rosin, the emulsion is destroyed; the water impregnates the fiber and the pigmented glycerophthalic rosin remains on the surface of the latter. When drying, the water leaves the fiber and passes through the rosin film which oxidizes and which will continue to oxidize according to a process which can be designated by the name of fixing. If, throughout the period of time during which the water is eliminated, the glycerophthalic film remains sufficiently plastic, the ulterior fixing of the latter causes the formation of a smooth and homogeneous film on the surface of the fiber; if, on the contrary, the film dries too quickly, the elimination of the water crackles the pigmented rosin film, and the film, after fixing, is coated with a more or less spongy layer; it is easy to understand that under these conditions the printing obtained resists less to rubbing than that obtained with a smooth and homogeneous film.

Consequently, in order to obtain a maximum resistance it is necessary either to control the drying and fixing conditions or to choose kinds of rosins which give a plastic film during the whole time the water is being eliminated irrespective of working conditions. This latter result has been obtained according to the present invention by resorting to glycerophthalic rosins which when exposed to air dry slowly in depth, and are of an oil-long type, and more particularly to glycerophthalic rosins possessing these characteristic features and which are produced from soya-bean oil.

The products obtained according to the present invention allow, after printing, of drying and fixing under the broadest conditions: exposing to air for 20 to 48 hours will be sufficient for giving prints which resist rubbing and alkaline soaping well; it will be possible, immediately after printing to dry for a few minutes in a drying-room at temperatures of 60 to 100° C. in order to eliminate the water and, before effecting a fixing operation, to roll or pile up the printed pieces.

The specification of patent No. — — also states as has already been mentioned above that the glycerophthalic rosin is ground with a pigment, possibly in the presence of solvent for this rosin, and that the so obtained pigmented enamel is emulsified in water. However, in the different practical embodiments given in the said specification, the rosin is always ground with the pigment in the presence of a solvent; now, by the present invention, another form of execution may consist in submitting the mixture of rosin and pigment to an intensive mechanical working in the absence of a solvent until the pigment has been sufficiently dispersed in the rosin; this mechanical working can be effected, for example, in a calender. Then the dispersion of the pigment in the rosin is emulsified in water.

However, the siccative glycerophthalic rosins which are used for carrying out the invention as described in the specification of Patent No. can be prepared, as specified, according to any known method; according to the indications in

Patent No. they must at least contain radicals of phthalic acid, of glycerine and of siccative fatty acid, but they also contain radicals of other polybasic acids, of other polyalcohols, of monoalcohols or of monobasic acids other than siccative fatty acids. Now, it has been found, according to the present invention, that it is possible to replace the totality of the glycerine by other polyalcohols such as glycol, pentaerythrite, thiodiglycol, butanediols, and the totality of the phthalic acid by other polyacids such as maleic acid, succianic acid, citric acid, while choosing however, according to the current technic of the manufacture of rosins of the "polyalcohol-polyacid" kind, such proportions or such mixtures of the said bodies, that the properties of the rosins are similar to those of the siccative glycerophthalic rosins. In a like manner, one would not depart from the scope and spirit of the invention by using composite rosins of the kind comprising polyalcohols, polyacids, siccative fatty acids and other resinous substances, the properties of which are similar to those of the siccative glycerophthalic rosins.

Several non-limitative examples will be given.

Example I

100 parts of glycerophthalic rosin basically composed of soya-bean oil the global composition of which obtains 60% of oil are ground in the grinding mill, after an addition of white spirit, with 10 parts of a pigment known on the market under the name of "Monastral Blue BS" so as to obtain a pigmented enamel of the following composition:

	Parts
Rosin	100
White spirit	100
Monastral Blue BS	10

This pigmented enamel is added little by little to a solution of:

	Parts
Methylcellulose	15
Triethanolamine	5
Water	135

A concentrated printing colour is thus obtained which may if desired be again passed through a grinding mill. To this colour are added while stirring:

100 parts of xylene, and slowly
255 parts of water.

A printing colour is then obtained which is ready for use.

After printing, the fabric is dried for 5 minutes at 60–100° C. in order to eliminate the water and is then piled up or rolled up.

The fixing can be obtained either by exposing for 24 hours in free air or by passing through a drying-room. By way of indication one may proceed to a drying operation in a drying-room for 20 minutes at 120° C. or 6 minutes at 160° C.

Under these conditions impressions are obtained which hold fast with respect to rubbing and to alkaline soaping under boiling conditions.

Example II

100 parts of a glycerophthalic rosin basically composed of soya-bean oil and the global composition of which obtains 57% of oil are ground, after an addition of white spirit, with 10 parts of the pigment known on the market under the name of "Monastral Green GS" so as to obtain a coloured enamel corresponding to the following composition:

	Parts
Monastral Green GS	10
Rosin	100
White spirit	100

This pigmented enamel is added little by little, while stirring, to 150 parts of a thick suspension of bentonite of 8.25% to which 5 parts of triethanolamine may or may not be added; a concentrated printing colour is thus obtained. To this colour are added while stirring:

100 parts of xylene, and then slowly
255 parts of water.

A printing colour ready for use is thus obtained.

After printing and exposing the fabric to air for 24 hours impressions are obtained which hold fast when the fabric is submitted to boiling alkaline soaping and rubbing.

Of course, drying operations in the drying-room over suitable periods of time lead to equivalent results.

Example III

100 parts of a glycerophthalic rosin basically composed of soya-bean oil and the global composition of which obtains 60% of oil are ground after an addition of white spirit with a pigment paste known on the market by the name of "Lutecia Scarlet NRF" corresponding to 50 parts of dry pigment, so as to produce an enamel comprising:

	Parts
Lutetia scarlet NRF	50
Rosin	100
White spirit	100
Water	100

This pigmented enamel is added little by little, while stirring, to 150 parts of a thick suspension of bentonite of 8.25% to which 5 parts of triethanolamine may or may not be added. To the so obtained concentrated colour are added, while stirring:

125 parts of white spirit and then slowly
155 parts of water.

A printing paste ready for use is thus obtained.

After printing the fabric is passed through a drying-room for 5 minutes to remove the water and allow a possible rolling or piling up.

The fixing can be effected either by exposing to air or by passing through a drying-room. By way of indication, the fixing time is 48 hours when spreading out, and 20 minutes at 120° C. or 6 minutes at 160° C. when passing through the drying-room.

Example IV

100 parts of a rosin prepared by condensation of soya-bean oil, phthalic anhydride, maleic anhydride, pentaerythrite and glycol and the global composition of which obtains 57% of oil are ground in a grinding mill, after an addition of white spirit, with 50 parts of iron oxide in order to obtain an enamel having the following composition:

	Parts
Iron oxide	50
Rosin	100
White spirit	100

This pigmented enamel is added little by little to a thick solution of bentonite of 8,25% to which 5 parts of triethanolamine may or may not be added. A concentrated printing colour is thus

obtained. To this latter are added, while stirring, 70 parts of white spirit and then slowly 255 parts of water. A printing colour ready for use is thus obtained.

The viscosity of this printing paste can be made to vary, (as well as, as a matter of fact, the viscosity of the printing pastes described in the foregoing examples) by cautiously adding an organic solvent (diluant) or water (thickening agent). After exposing the fabric to air for 24 hours impressions are obtained which resist alkaline soaping and rubbing well. Drying operations in a drying-room for periods of time determined by preliminary trials lead to equivalent results.

Example V

100 parts of a glycerophthalic rosin basically composed of soya-bean oil and deshydrated castor oil the global composition of which obtains 75% of oil are ground in a grinding mill (which may be heated) with 10 parts of "Monastral Blue BS" so as to obtain a ground mass having substantially the following composition:

	Parts
Rosin	100
Monastral Blue BS	10

This pigmented enamel is added little by little to a solution of

	Parts
Methylcellulose	15
Triethanolamine	5
Water	135

A concentrated paste is thus obtained the viscosity of which is adjusted before using by adding the required quantity of water.

After printing, the fabrics are treated in the same manner as in the foregoing examples and impressions are obtained which resist boiling alkaline soaping and rubbing well.

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ALIEN PROPERTY CUSTODIAN

COMPRESSOR PLANT AND METHOD FOR REGULATING THE QUANTITY OF WORKING FLUID DELIVERED THEREBY

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Application filed November 24, 1941

In the operation of rotary compressors, the regulation of the quantity of compressed working fluid delivered presents difficulties in those cases in which it is by means of a delivery pipe of practically constant pressure that the working fluid is conducted towards the place of consumption. This is due to the well-known fact, that it is only on the descending section of the pressure-volume characteristic (i. e. on the section in which, with growing pressure, volume decreases) that such compressors operate in a stable manner, and even in this range of operation it is only at or above the working pressure of the delivery pipe that it is possible to work, as otherwise backflow directed towards the compressor would be set up in the delivery pipe. This circumstance substantially limits the range of regulation and this limitation becomes more appreciable still because—in view of other considerations, but also owing to inherent features of construction—the preponderating majority of the compressors concerned possess a so-called "steep" pressure-volume characteristic. This means that the percentage by which the volume of the working fluid delivered diminishes with increasing pressure is smaller than the percentage by which the pressure increases, so that in order to alter the gas volume delivered in a certain proportion the pressure has to be altered in a relatively higher proportion. Thereby, not only the range of regulation, narrow as it is already, will be rendered more narrow still, but substantial deviations of the pressure from the figure of pressure which it is desirable to maintain constant as far as possible in the delivery pipe will also be caused, which circumstance, seeing that, in view of what has been said above, any such variations of pressure can only be variations above the figure of nominal pressure of the delivery pipe, will also mean an increase in the quantity of power required, and will thus tend to render operation less economical.

According to the invention these difficulties can be eliminated by employing, for providing the desired service, two or more compressors, mutually connected in parallel, the said compressors being operated singly or connected in parallel in the various possible combinations, according to what quantity of working fluid is to be delivered, a number of steps of regulation being thus obtained at the desired pressure. In order to increase, in the manner which will appear from the examples as below, the number of steps of regulation, it is advisable to construct the various compressors so as to possess different output capacities. With this arrangement, the employment of two compressors will already enable three steps to be obtained, whilst the employment of three compressors will enable five or seven steps to be obtained, according to whether in this latter case two of the three compressors or all three compressors are chosen so as to possess different output capacities. At the same time the output capacities of the individual compressors should preferably be so chosen as to enable steps of regulation distributed as uniformly as possible to be obtained within the maximum output capacity of the whole equipment. Transitional regulation (intermediate regulation) between the individual steps can be effected by the methods employed up to now (e. g. by means of throttling, which will not cause any appreciable loss of power or diminution of efficiency).

A general diagram of the invention in case of employing two compressors operated in parallel is represented on Fig. 1, whilst Fig. 2 represents an embodiment, shown by way of example, comprising two compressors likewise, and Fig. 3 one comprising three compressors.

The compressors 1 and 2 employed in the arrangement as per Fig. 1 are connected on the one hand to the suction pipe 4 and on the other hand to the delivery pipe 5, to which pipes they join on by means of the suction and delivery branches 4′, 4″ and 5′, 5″, respectively. The driving devices of the compressors 1 and 2 may be of any desired kind (mutually dependent or independent), and if the mutual difference existing between the output capacities of the said compressors is such that the output capacity of compressor 1 is smaller and that of compressor 2 greater—for instance twice as great as the output capacity of compressor 1—it is possible, taking the joint output capacity of the compressors 1 and 2 as 100%, to obtain the first step of regulation, representing an output capacity of 33, 33% by operating compressor 1 and cutting out compressor 2, the second step of regulation, representing an output capacity of 66, 66%, by operating compressor 2 and cutting out compressor 1, whilst the third step of regulation, representing an output capacity of 100%, is obtained by operating the two compressors 1 and 2 jointly.

If, in accordance with the first step of regulation, the compressor 2 is put out of commission, its delivery branch 5″ has to be shut off, by means of the closing device (valve) 6″ built into the said branch, from the delivery pipe 5 standing under pressure in consequence of the oper-

ation of the compressor 1. In the second step of regulation it is the delivery branch 5′ of the compressor 1 that has to be shut off, in a similar manner, by means of the closing device 6′, from the delivery pipe 5. In case the driving devices of the compressors 1 and 2 are mutually independent, either of these compressors can be put out of commission simply by shutting down its driving device, whilst, in case the driving devices are not independent from each other, the high-pressure end of the compressor put out of commission may be brought into connection—in the case of compressor 2, by opening the closing device 7″—with the atmosphere, or—in the case of compressor 1, by opening the closing member 7′—with the suction conduit 4, thereby ensuring that the compressor put of of commission will, notwithstanding its rotation, require practically no energy for driving it apart from the quantity necessary for overcoming frictional resistances.

In case the various compressors are driven in a mutually independent manner, special working turbines, electric motors, or the like, may be employed for driving them. Fig. 2, which is substantially identical with Fig. 1, represents a set of apparatus comprising driving arrangements of this last-named kind, the electric motors 12′ and 12″ being employed for driving the compressors 1 and 2, respectively. After identifying the constructional parts marked in mutual conformity on Figs. 1 and 2, the method of operation of the apparatus will be readily understood without any further explanation, the difference consisting only in that the compressor 1 of smaller output capacity is fitted, in addition to the stop-valve 7′ leading back through the duct 9′ towards the suction branch 4′, also with a stop-valve 8′ for discharge into the atmosphere, and, moreover, in that the closing device 7″ of the compressor 2 of larger output capacity, instead of opening a conduit leading into the atmosphere, opens the way through the return conduit 9″ towards the suction branch 4″ of this compressor, the closing device 7″ being of a double type, which, in addition to opening the branch 10 joining on to the discharge branch 5″ of the compressor, and already before opening this branch, also opens the branch 11 joining on to the middle section of the working space of the compressor. The purpose of the constructional details differing from or representing an addition to those represented on Fig. 1 will be explained in what follows.

In the embodiment shown by way of example on Fig. 3 three compressors 1, 2, and 3, the driving devices of which are not independent from each other mechanically, are provided; the mutual relations between the various driving devices are such that the compressors 1 and 2 are mutually connected by means of the disconnectable clutch 14 through the tooth-wheel gear 13, whilst the compressors 2 and 3 are mutually connected in a direct manner by means of the disconnectable clutch 15; it is accordingly possible, by putting these disconnectable clutches out of gear, to place each individual compressor, or possibly any pair of compressors, entirely out of commission or to render them independent from each other as to their driving devices, provided that provision is made (in a manner not shown on the drawing) for enabling any compressor which is to be operated but which has been disconnected by means of the clutches 14 or 15, respectively, to be brought into connection with the source of motive power from another side. Considering the constructional parts marked in conformity with, or analogously to, Figs. 1 and 2, it will appear that, as far as the method of functioning of the apparatus is concerned, the addition of the compressor 3 and of the pipe branches 4‴, 5‴, joining on to it and of the closing device 6‴ does not mean any essential alteration as compared to the arrangements described in what precedes, whilst a modification as compared to Fig. 2 is apparent in that, instead of compressor 1, it is the compressors 2 and 3 which, in addition to other closing devices, are also fitted with the closing devices 8″ and 8‴, respectively, for discharge into the atmosphere, whilst the return duct 9″ of the compressor 2 contains, instead of the double closing device 7″, two mutually independent closing devices 7″*a* and 7″*m*, for controlling the branches 10 and 11, respectively.

In the case of the arrangement according to Fig. 3, it is possible to provide for all three compressors, or for two compressors only possessing different output capacities. Taking the joint output capacity of the three compressors as 100% and taking the output capacities of the individual compressors proceeding from compressor 1 to compressor 3 as amounting, in order sequence, to, for instance, 15%, 30% and 55%, the following steps of output capacity will be obtained:

Step No. 1: compressor 1 by itself (15%)
Step No. 2: compressor 2 by itself (30%)
Step No. 3: compressors 1 and 2 jointly (45%)
Step No. 4: compressor 3 by itself (55%)
Step No. 5: compressors 1 and 3 jointly (70%)
Step No. 6: compressors 2 and 3 jointly (85%)
Step No. 7: compressors 1, 2 and 3 jointly (100%).

If, on the other hand, the distribution of output capacities is such that for instance compressor 1 is capable of providing 20% of the total output capacity whilst compressors 2 and 3 are, in a mutually equal manner, each capable of providing 40% of the total output capacity, it will be possible to produce the following five steps of output capacity:

Step No. 1: compressor 1 by itself (20%)
Step No. 2: compressor 2 or 3 by itself (40%)
Step No. 3: compressors 1 and 2 jointly (60%)
Step No. 4: compressors 2 and 3 jointly (80%)
Step No. 5: compressors 1, 2 and 3 jointly (100%).

In view of increasing the number of steps produceable it is, accordingly, preferable that all three compressors should possess different output capacities.

In case any compressor put out of commission continues to be kept in rotation, whilst connecting its delivery branch with the atmosphere, or through a return conduit with its suction branch or with the common suction pipe, it is advisable to effect a return towards the suction end from one or more branchings of the working space of the cut-out compressor also, such connection resulting after suitable closing devices are opened. Details of arrangement of this kind are the intermediate branchings 11, already mentioned above, comprised in the arrangements according to Figs. 2 and 3, as well as the double closing members 7″ or independent closing members 7″*m* controlling the junction apertures of the said branchings. The reason why such an intermediate return duct or such intermediate return ducts are desirable is that, in view of the fact that in accordance with the compression in normal

operation of the cut-out compressor the throughflow cross-sections in the working space of the compressor diminish towards the delivery end, the velocities will, in case of the compressor running at no-load, become substantially increased towards the delivery end, which circumstance will, in consequence of the increase of the resistance to flow, result in a temperature rise of the working fluid i. e. in increased losses. If now the working fluid is returned from intermediate branching points, these losses will, of course,—owing to the diminution of the throughflow speed behind the branching—become reduced.

The returning of the working fluid from the delivery end of the compressor put out of commission or from an intermediate point of its working space, in consequence whereof a certain quantity of working fluid will flow repeatedly through the compressor put out of commission referred to, will, particularly for this last-named reason, result in the temperature rise, just mentioned, of the working fluid. This will, however, notwithstanding the drawback mitigated by the return from the intermediate branching, also result in a certain advantage, so that the loss itself caused by this phenomenon will, in addition to the mitigation produced by means of the returning, be mitigated also owing to a further reason, which latter mitigation will take effect also if no intermediate returning is employed at all. Notably, if the working fluid becomes heated up in consequence of the repeated no-load throughflow, this will cause its density and thus the amount of energy absorbed by it, which must counted as a loss, to become reduced. Advantageous use may be made of this circumstance also in connection with the balancing regulation between the various steps; notably, this regulation can also be effected in such a manner that the closing devices of the apertures for discharge into the atmosphere, or for return are—for the purpose of producing throttling—opened, partly only, also at those times when the compressor in question is not shut down, which will enable the transitional regulation between the various steps to be effected with a relatively slight loss. Accordingly, in order to effect such a regulation, the various closing devices, for instance in the arrangement according to Fig. 2 the valves 7′, 8′, or the double valve 7″, or, in the arrangement according to Fig. 3, the closing devices 7′, 7*a*″, 7*m*″ 8″ and 8‴, respectively, (in the first place the closing devices effecting the return of the working fluid) may in ordinary operation also be operated as throttle-valves, and should be constructed in accordance with this function.

At the occasion when the working fluid is being partly returned, either in order to place any compressor out of commission or for the purpose of the regulation between steps referred to, any excessive temperature rise should be limited as far as possible, which purpose can be achieved either by means of the natural cooling-down of the working fluid, or by means of cooling the latter artificially. The artificial limitation of temperature, effected for this purpose, can be produced by means of a simple type of equipment, for instance by allowing a part of the working fluid flowing back to escape into the atmosphere, and replacing this deficiency by means of suction from the atmosphere, in which case the quantity of fresh working fluid thus drawn-in will figure as the cooling medium of the quantity of hot working fluid returned into the current of working fluid. In the case of the embodiment according to Fig. 2, this should, accordingly, in the case quoted by way of example of effecting the regulation of compressor 1, be understood to mean that the throttling devices 7′ and 8′ are kept open in the necessary extent simultaneously by means of a control mechanism not shown on the drawing, in which case the replacement of the quantity of working fluid discharged into the atmosphere through the closing device 8′ will be effected automatically through the suction conduit 4 and through the suction branch 4′ of the compressor.

The arrangements represented on the figures having the character of examples, it will of course be possible to vary at will, in accordance with the purpose aimed at in each case, the number of compressors connected in parallel, and the mutual distribution of their output capacities, as well as the arrangement and the control, taking place partly in mutual dependence, of the closing devices for producing the various steps of regulation as well as the transitions between these steps. In order to ensure the uniform distribution, referred to precedingly, of the steps of output capacity, it is advisable that—as apparent also in connection with the examples described—the output capacity of the compressor having the greatest output capacity should be at least twice that of the compressor having the lowest output capacity, or even greater. Similarly the arrangements for driving the individual compressors or for driving them in mutual dependence, possibly from a common source of power, may be of any desired kind and of the most varied kinds. It will, however, in the same way as in the case of the examples described, be important in each case that the compressor disconnected from the service should be relieved of all pressure (it being possible to ensure this either by stopping the rotation of the compressor, or, in case of the compressor continuing to rotate, by connecting its delivery and with the suction end or with the atmosphere), since with the delivery end completely closed the maintenance of the pressure in the compressor put out of commission would cause a disadvantageous temperature rise and a deterioration of the efficiency.

GEORGE JENDRASSIK.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

G. JENDRASSIK

COMPRESSOR PLANT AND METHOD FOR REGULATING THE QUANTITY OF WORKING FLUID DELIVERED THEREBY

Filed Nov. 24, 1941

Serial No. 420,283

2 Sheets-Sheet 1

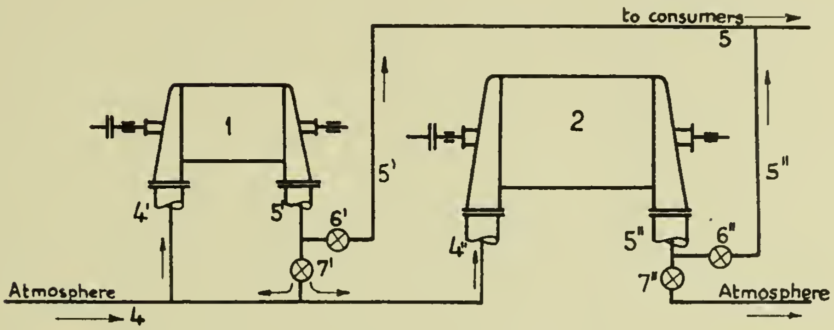

Fig. 1

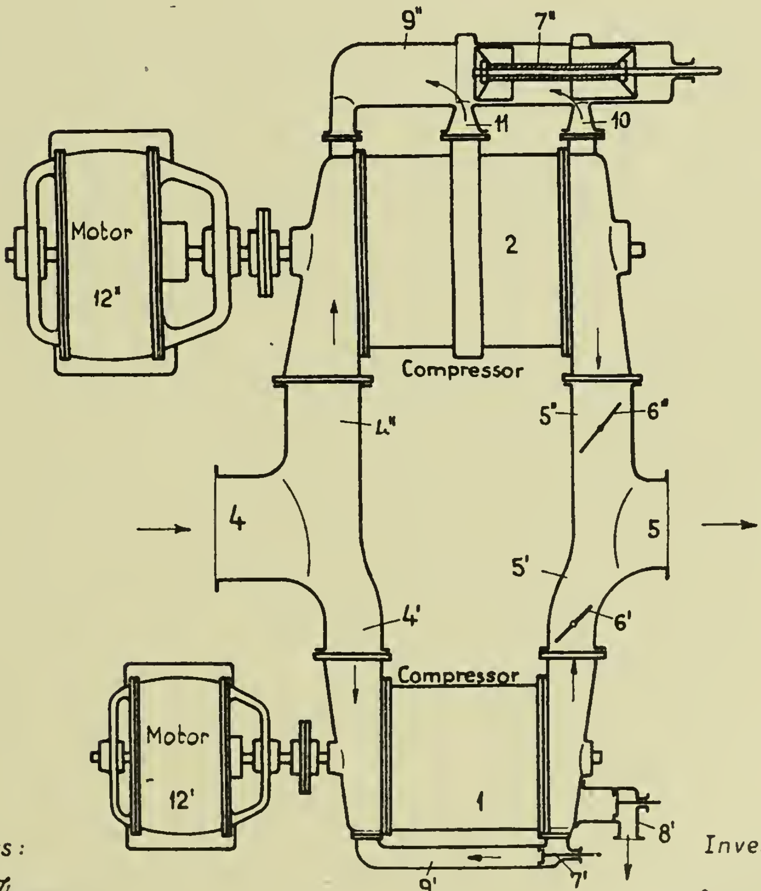

Fig. 2

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Serial No.
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2 Sheets--Sheet 2

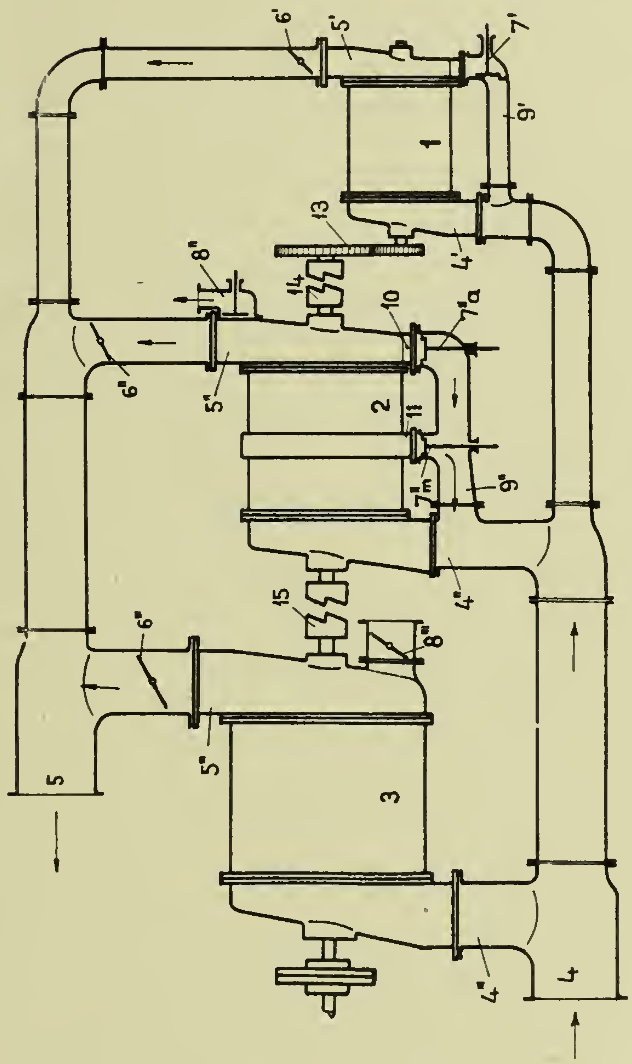

Fig. 3

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Published June 8, 1943 Serial No. 424,754

ALIEN PROPERTY CUSTODIAN

PROTECTING DEVICES FOR NETWORKS

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Application filed December 29, 1941

This invention refers to the realization and to the particular arrangement of elements serving, by the intermediary of a bilateral connection comprising supporting currents or others for the protection of lines conveying electric energy from short-circuits between phases and the earth contacts. The improvements realized according to the invention cause the reduction to its minimum of the time elapsed from the apparition of the defect to the instant at which the switches serving to isolate the defective section of the line are acted upon, and the untimely working of the protection is obviated.

These improvements refer, in the whole or in part, to any protecting system requiring a great working speed. However, in order to realize the invention it is supposed applied to a protection by supporting currents according to the scheme of the Fig. 1, in which 1, 2, 3 are three portions of a line conveying energy separated by two posts 4 and 5; the portion 2 may be isolated from the portions 1 and 3 by opening the switches 6 and 7 respectively placed in the posts 4 and 5.

The elements which serve in each post for the protection of the portion 2 are: the relays 8 and 9 "for the start," the directing relays 10 and 11 controlling the flowing direction of the energy, the emission devices of supporting currents 12 and 13, the reception devices of supporting currents 14 and 15, these devices feeding two relays 16 and 17 said "bolting relays."

The selective elimination of the defects is obtained by the realization of a double condition: in order that the switches 6 and 7 may be opened:

(1°) The relays said "starting relays" 8 and 9 must then work;

(2°) The relays said directing relays must be in a position corresponding to the flowing of the capacity of the bars of the posts 4 and 5 to the line 2. In any other case, the protections must be bolted.

Normally, the starting relays 8 and 9 are in rest position, the directing relays 10 and 11 are maintained in the position corresponding to the flowing of the capacity of the line 2 to the bars of the posts 4 and 5, the bolting relays 16 and 17 are maintained in the bolting position by the aid of the starting relays. The senders 12 and 13 do not act upon the receivers 14 and 15.

In case of a defect on the portion of the line 2, the starting relays 8 and 9 work and disengage the relays 16 and 17 from their bolting position; at the same instant, the directing relays 10 and 11 leave the position fixed to them and hinder the senders 12 and 13 from being acted upon and from acting upon the receivers 14 and 15. The switches 6 and 7 release and isolate the defect portion 2 of the portions 1 and 3.

In case of defects on the portion 3, the starting relays 8 and 9 work and cut the local feeding of the bolting relays 16 and 17, the directing relay 10 leave its rest position but the directing relay 11 remaining in rest position start the sender 13 which acts upon the receivers 14 and 15. The bolting relays 16 and 17 are fed again and cannot leave their bolting position. They hinder, in this manner, the switches 6 and 7 from opening.

In case of defects on the portion 1, the process is reversed, i. e. the working of the protection of the post 5 is identical with the working of the protection of the post 4 in the precedent case and inversely.

After the opening of the switches of a defective portion, the portion 2 excepted, and which brings about the elimination of the defect, the protecting elements of the portion 2 which have been started come back in their rest position. During this transitory regime, an untimely working of the switches of this portion may take place.

Thus, for instance, if the defect were to happen on the portion 3 the moveable contact of the directing relay 11 was strongly applied on its rest contact. After the disappearance of the defect, the action of the moveable contact suddenly undergoes a weakening, this contact may rebound and swerve momentarily from its rest contact. It would then be in a position corresponding to the directions of the current of the bars of the post 5 towards the line 2. If this takes place before the starting relay 9 comes back into its rest position, the protections of this post 5 and of the post 4 are in the same conditions as when a defect happens on the portion 2. The switches 6 and 7 have then opened untimely.

In order to avoid this drawback, each protection comprises a supplementary relay 18 and 19 said of "lengthening the bolting" which introduces a supplementary breaking off in the release circuit during the bolting, this breaking off being suppressed, when the protecting elements come back to their rest position, after such a space of time that no untimely release can be brought about.

It is possible to obtain, by making a judicious choice of the devices constituting this arrangement and by a whole of improvements in the execution and the branching of these devices, a very reduced working time of the protection in

the case of an interior defect in the protected section, the arrangement keeping its selective qualities in the case of an exterior defect in the section.

This improvements taken in their whole or separately make up the object of this invention.

A first improvement is given by a directing relay sensible to a reverse component and to the homopolar component of the capacity. These components are nought in balanced regime, the moveable equipage of the relay being solicited by no electric couple and may be brought into a determined position by a mechanical couple or by any other couple.

However, it is necessary to avoid changes of place of the moveable equipage in the case of unequilibrium which does not act upon the starting relays. This result is obtained, according to the present invention, by the action of an electro-magnet fed by the intermediary of the resting contacts of the "starting" relays and which maintains the movable equipage of the directing relay in the determined position, without contact with a fixed buttress Fig. 2 gives a not restricting example of the arrangement of an electromagnet fulfilling this condition:

The moveable equipage, not represented, of the directing relay turns round an axis **20** on which is rigidly fixed an arm **21** supporting a paddle **22** made up of soft steel; this paddle may come, by the rotation of the equipage, into the air-gap of an electro-magnet **23** having the shape of C the poles of which are cut in bevel. The equilibrium position of the moveable equipage, when the electro-magnet is crossed by an excitation current, is the air-gap position minimum; it is defined by no buttress and gives no reaction on the moveable equipage in case of a sudden cut-out of the feeding current of the electro-magnet **23**. This arrangement enables the liberation of the moveable equipage at the very moment when the starting relay works without giving him an impulsion which could adulterate the control of the direction of the capacity. Moreover, the feeding again of this electro-magnet at the moment of the coming back into rest position of the starting relay accelerates the recall of the moveable equipage of the directing relay to its primitive position.

For the control of the direction of symmetrical defects which do not influence the directing relays sensible to the reverse component and to the homopolar component of the capacity, an artifice described in the French Patent No. 738,844 of the 20th June 1932 makes it possible to render these directing relays sensible to the direct component of the capacity by a suitable commutation of the elements of the filtering circuit which feeds them. This commutation may greatly increase the working time of the protection if it is not sufficiently rapid in order that the lengthening relay of bolting has no time to be excited. An improvement is foreseen in the present invention which consists in interrupting the feeding of the lengthening relay of bolting during the commutation of the filter of the directing relay, in case of a balanced defect.

An essential condition for the rapid working of the protection when supporting currents are used is given by the fact that the sender of supporting currents oscillates in permanency for want of which the necessary time for the feeding of the bolting relays would be increased by the time necessary to the corresponding senders to attain the oscillatory regime. The same remark is available for the oscillations serving to modulate the supporting wave in the arrangements of a great selectivity.

The present invention foresees the permanent oscillation of the sending posts and eventually of the modulators of the connections comprising supporting currents serving to the protection by taking care that the oscillations can be transmitted to the corresponding receivers only when the starting relays have worked and only when the directing relays of the examined protections are in a suitable position. Fig. 3 gives by way of example, nowise restrictive the scheme of such an arrangement. Suppose a system of supporting currents comprising an oscillator **24** supplying a supporting wave modulated by the oscillator **25**; these two devices are connected electrically by two connections **26** and **27** connecting an outlet transformer **28** arranged in the modulator and an attack transformer **29** arranged in the oscillator. This connecting circuit may have such dimensions that by short-circuiting, by the aid of a contact **30**, the connections **26** and **27**, or by releasing one of the connections **26** and **27** by opening a contact **31**, the supporting wave is no more modulated without the oscillations of the sender **24** nor that of the modulator **25** is interrupted. If the contact **30** be a rest contact of the starting relays and if the contact **31** be connected with the directing relay and become opened when this latter relay is acted upon in the direction of supervision, the device comprising supporting currents can be started only when the defect happens to be in the reverse direction to that of supervision.

For the same reasons of rapidity and security, the answering time of the receiver must be reduced to a minimum, i. e. the time comprised between the instant at which the oscillations brought about by the sender appear at the entrance of the receiver and the instant at which the bolting relay is crossed by the plate current resulting from the outlet lamp of the lamp, must be as short as possible.

This result is obtained in the present invention by the following improvement: it is known that, in order to increase the selectivity of the connection comprising supporting currents, it is necessary to modulate the supporting wave at a low frequency with respect to that of the supporting wave itself. On the other hand, in order to obtain a great rapidity of the bolting relay with a capacity as reduced as possible, it is profitable to make use of a relay comprising a fixed relay and a moveable spool. This spool must be feed with continuous or rectified current thus compelling to detect the modulated current supplied to the receiver by the sender. If such a detection be obtained by the aid of characteristic plate or with the help of a characteristic grate of one of the lamps of the receiver, it shall be necessary to introduce into the considered circuit a capacity offering a low impedance to the modulated current. This capacity will introduce a not negligible time constant, more particularly if the modulation frequency be low.

According to the invention, the receiver to be used will be an amplificator of an alternating current and a transformer of suitable dimensions feeding the bolting relay by the aid of a rectifier will be inserted into the circuit plate of the last lamp. Such an arrangement offers, moreover, the advantage of insulating the bolting relay of the feeding circuits of the receiver and to enable its simultaneous connection with another

source of current thus making possible the local bolting and the bolting by supporting currents by the aid of a relay the moveable equippage of which comprises only one winding, i. e. having the greatest efficiency.

Fig. 4 gives an example of a scheme of auxiliary source circuits of a protection comprising supporting currents, the improvements according to the invention being there applied.

Each of the starting relays 32, 33, 34, for defects between phases, possess two contacts having openings 32′, 32‴, 33′, 33‴, 34′, 34‴ (closed contacts when the relays are in rest position). Each of them has, moreover, a closure contact (opened in rest position) 32″, 33″, 34″. The starting relay 35n for the earth defects, is provided with an opening contact 35′ and with a closure 35″. The contacts 32″, 33″, 34″, 35″ are branched in parallel and control the feeding of an intermediary relay 36 provided with two opennig contacts 36′, 36″ and with a closure contact 36″. The contact 36′ is in parallel with the contact 37′ of the directing relay 37, this contact 37′ opening only in the case of a defect in the direction of supervision. The contact 36‴ short-circuits the secondary of the outlet transformer 38′ of the modulator 38. The whole of the contacts 36′, 37′ secures a connection between the secondary of the transformer 38′ and the primary of the attack transformer 39′ of the oscillator 39 supplying the supporting wave. On the other hand, this same whole of contacts 36′, 37′ is in series in the feeding circuit of the moveable spool of the bolting relay 40.

The contacts 32′, 33′, 34′, 35′ of the starting relays are connected in series in the feeding circuit of the electro-magnet 37″ maintaining the moveable equippage of the directing relay 37 in rest position. The contacts 32‴, 33‴, 34‴ are connected in parallel an their whole short-circuits the commutation relay 37‴ of the directing relay 37 and an auxiliary relay 41 which is provided with an opening-closure contact 41′.

A plug circuit 42 is inserted into the control circuit of the bolting relay 40, this plug circuit being regulated according to the frequency of the modulator 38 and foreseen for avoiding, when the contacts 36′ and 37′ are opened, the oscillator 39 from being modulated by a circuit connecting the transformers 38′ and 39′ by the intermediary of a local battery and the spool of the relay 40.

The relay 40 may be supplied, on the other hand, by the receiver 43 of the connection comprising supporting currents. The last lamp 43′ of this receiver has in its circuit plate a transformer 43″ the secondary of which is connected with a rectifier 43″ fixed in Wheatstone bridge, and the diagonal of which is placed the moveable spool of the relay 40. This relay is provided with an opening contact 40′ and a closure contact 40″ The contact 41′ of the auxiliary relay 41 is foreseen to cut, during the commutation of the directing relay 37, the feeding circuit of the lengthening relay for bolting 44. This relay is provided with an opening contact by excitation 44′ branched in series in the releasing circuit.

The device works then in following manner:

In case of a not balanced defect, interior with respect to the protected section, one or two of the starting relays 32, 33, 34, 35 work, the opening of one of the contacts 32′, 33′, 34′ or 35′ liberates the moveable equipage of the directing relay 37 which opens its contact 37′. The closure of one of the contacts 32″, 33″, 34″, 35″ acts upon the intermediary relay 36. The contact 36′ opens and the contact 36″ closes. The contacts 36′ and 37′ being opened no emission of supporting currents on the line takes place. Thus the bolting relays 40, at both extremities, are no more excited and close their contact 40″ which brings about the working of both switches 45.

In case of a balanced defect, interior with respect to the protected section, the three relays 32, 33, 34 work, the simultaneous opening of the contacts 32‴, 33‴, 34‴ causes the commutation relay 37‴ and the relay 41 to work, the latter relay hindering the lengthening relay for bolting to be acted upon by the closure of the contact 36″ during the time necessary to the commutation.

The remainder of the working is identical with that of the preceding case.

In case of a defect exterior to the protected section, the process is: In the post for which the defect is in the direction of supervision, the directing relay 37 opens its contact 37′ after the liberation of its equipage by opening one of the contacts 32′, 33′, 34′ or 35′. In the other post, the directing relay 37 keeps its contact 37′ closed. Consequently, at the opening of the contact 36‴, the modulator 38 acts upon the oscillator 39 the emission of which acts upon the receiver of the first post and keeps there the relay 40 in excitation position. The contact 40′ remains closed and the lengthening bolting relay being excited by the circuit of the contacts 36″ and 40′ opens its contact 44′ which cuts the releasing circuit still cut by the contact 40″. The same result is obtained in the second post, the relay 40 remaining excited because the contact 37′ has remained closed.

By this arrangement of contacts it is possible to use for the two posts of one section one supporting wave and one modulation having respectively in both posts either the same frequency or various frequencies.

The arrangements constituting the object of the present invention may be applied by the adjunction of supplementary organs to the protection of the lines provided with disjunctors said "separated phases disjunctors". The specific arrangement of these supplementary organs constitutes one of the characteristics of the invention. The secheme of the Fig. 5 on which are represented all the elements of the scheme of the Fig. 4 having the same signs, gives by way of example a particular arrangement of these supplementary organs.

The starting relay 35 is provided with a supplementary opening 35‴ contact. The disjunctor 45 is given with three separated poles the opening of which is respectively controlled by the three spools 45′, 45″, 45‴. Moreover, three relays 46, 47, 48 having closure contacts 46′, 47′, 48′ have been added to, these relays being chosen and branched in such a manner that only one defect on the phase they control brings about their working. These three relays control, respectively by their contacts 46′, 47′, 48′ the intermediary relays 49, 50, 51, each of them closing by excitation a contact 49′, 50′, 51′. At last, an intermediary relay 52 provided with three contacts closing by excitation 52′, 52″, 52‴ works after the closure of one of the contacts 32″, 33″, 34″ on condition that the contact 35‴ remains closed.

The working is the following: in case of defects between phases, one, two or three of the

relays **32**, **33**, **34** work, the relay **35** remain in rest position which brings about the working of the relay **52** which puts into parallel the spools of three poles of the disjunctor **45** which are simultaneously acted upon by the normal working of the protection.

In case of defect between the phase and the earth, the relay **35** and one of the relays **46**, **47** or **48** work, the relay **52** remain not excited, and one of the relays **49**, **50** or **51**, when working, makes it possible the release of the pole of the disjunctor corresponding to the phase in defect. This arrangement does not modify the working time of the protection, the selective operation can then be effected during the working of the protection proper.

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R. G. G. LÉORAT
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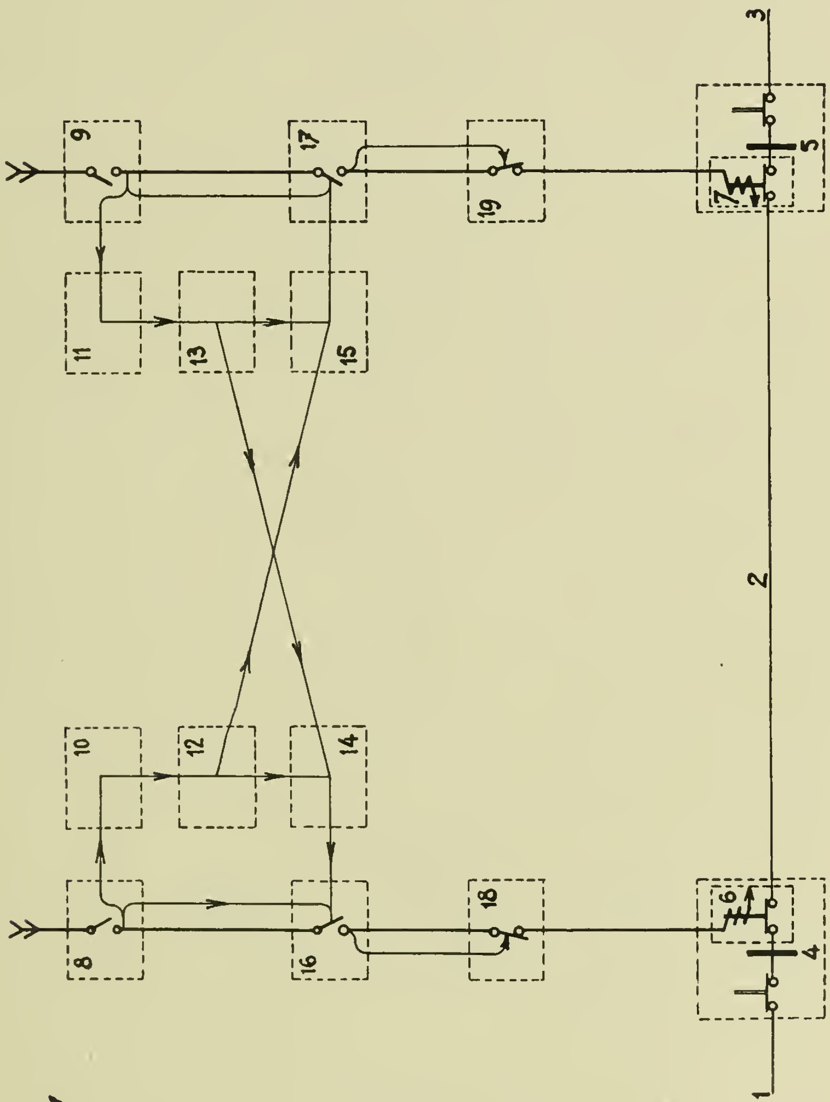

Fig. 1

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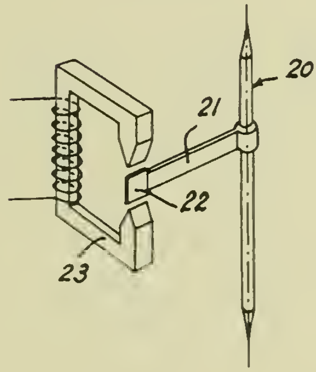
Fig. 2



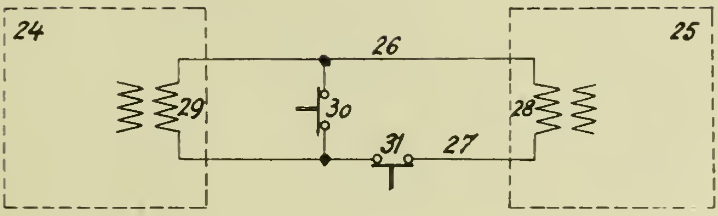


Fig. 3

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Fig. 4

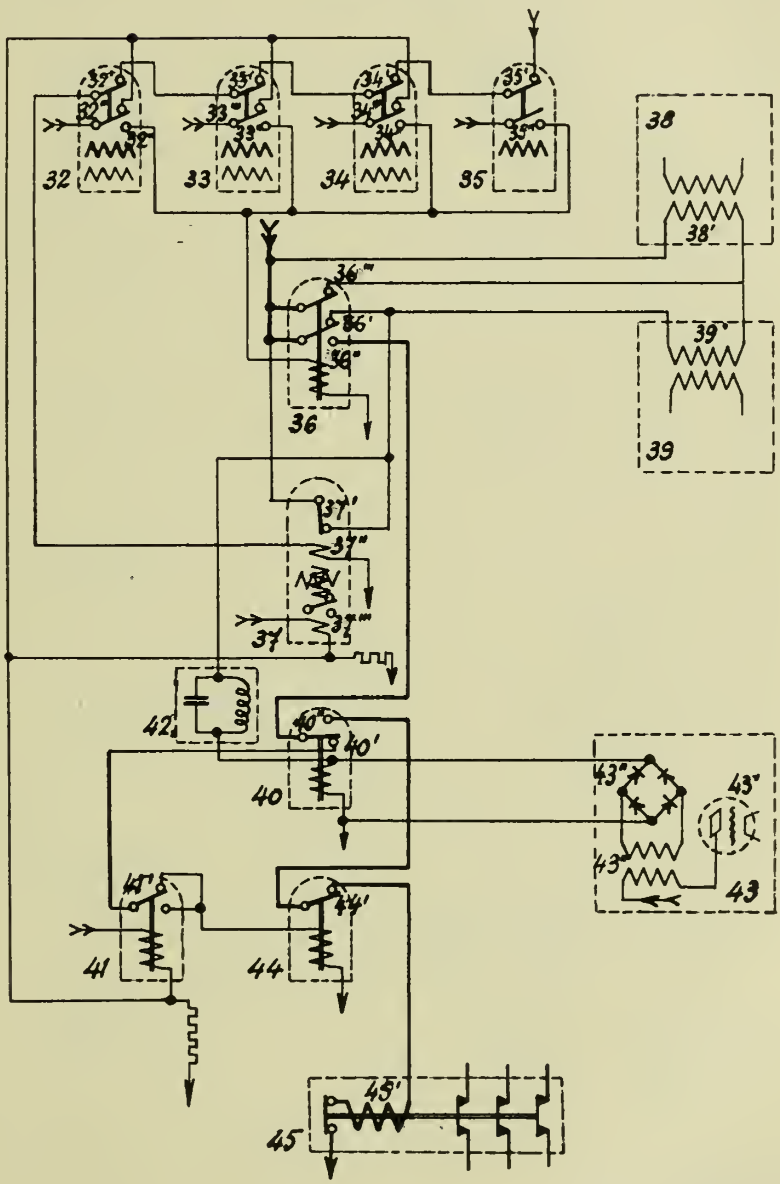

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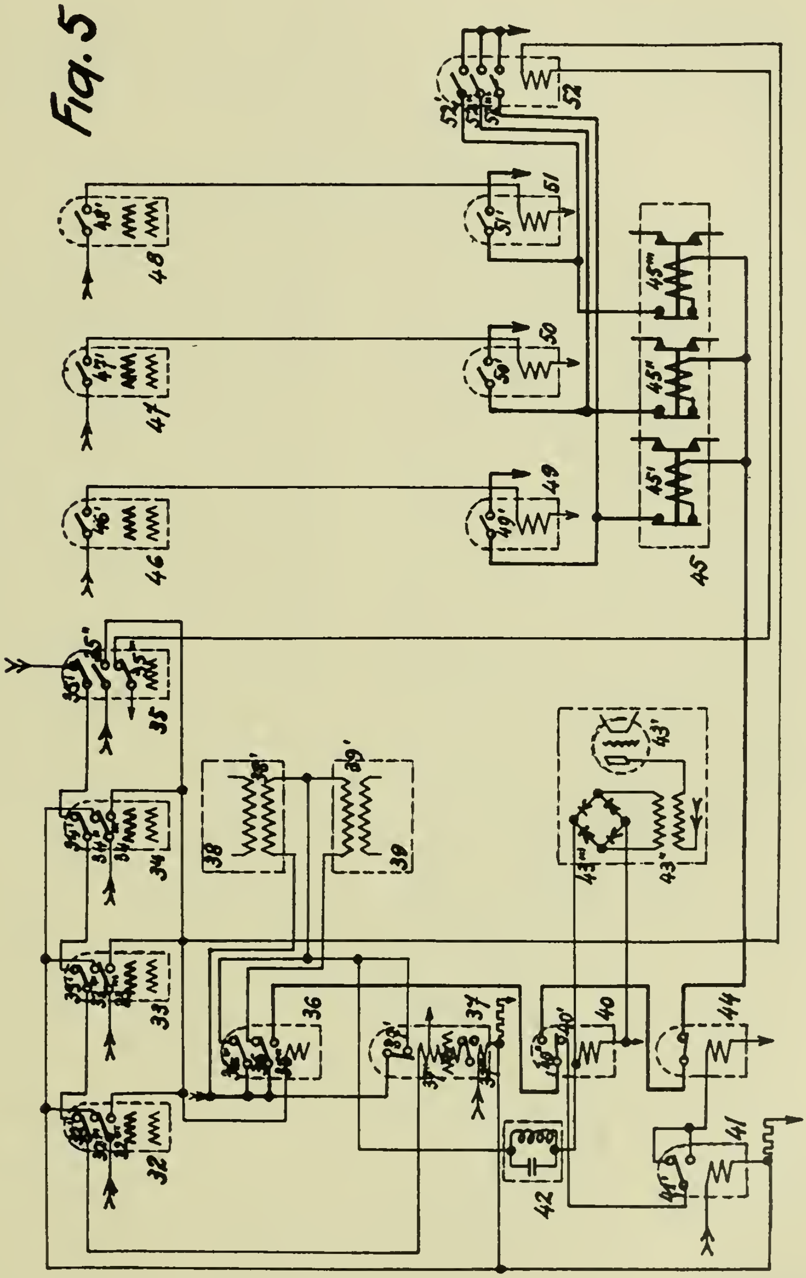
Fig. 5



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ALIEN PROPERTY CUSTODIAN

ELECTRIC FUSES

Olivier Ziegel, La Chapelle-Gauthier, France; vested in the Alien Property Custodian

Application filed January 27, 1942

The invention relates to electric fuses adapted to interrupt an electric circuit under the action of a rise of temperature and, thus to protect any suitable apparatus, machine, motor or installation against undue overheating, either of the apparatus itself, or of the surrounding objects subjected to the action of the heat developed by the apparatus.

This fuse essentially comprises a loose or movable conducting member, which is held in a fixed position and in a state of continuity in contact with the terminals of the electric circuit, by means of a sheath of fusible insulating material, the whole being arranged within an envelope of insulating material, or within an insulated envelope, whereby a rise of the surrounding temperature above a predetermined value, causes melting of the insulating material, thus releasing the conducting member which falls down or breaks down and looses contact with the terminals or otherwise interrupts the electric circuit.

In a preferred embodiment of the invention, the electric fuse according to the invention comprises a glass tube in which are arranged the terminals for the electric circuit, the movable or loose conducting member being constituted by a thin column of mercury, which bridges the two terminals and is held in contact with them by a sheath of wax or the like. At a determined temperature, which is constant for a fuse of determined construction, but varies according to the constructional data, the wax melts and releases the column of mercury, which breaks down or falls down and looses contact with the terminals, thus breaking the circuit.

In the accompanying drawing, which is given solely by way of example:

Fig. 1 is an axial section of a fuse according to an embodiment of the invention.

Fig. 2 shows a calibrated mandrel adapted for use in filling the fuse.

Fig. 3 is a view similar to Fig. 1, showing a modification of the invention, and

Fig. 4 is an axial section of an insulating sheath of fusible material for use in the device of Fig. 3.

According to the embodiment shown in Fig. 1, the fuse comprises a glass tube 1, which is slightly bulged in the middle, and whose wall is provided with an aperture 2. At both ends of said tube are secured the terminals 3—4 for connection with the electric circuit. The central part of the tube, between the terminals, is filled with wax, or like material, forming a sheath 5, the centre of which is provided with a cylindrical duct 6, filled with a thin column of mercury 7, in contact at its ends with the terminals 3—4.

For the manufacture of this fuse, the following method may be used: the terminal 4 is secured at one end of the tube and a core or mandrel 8, shown in Fig. 2, is introduced through the opposite end of the tube in the place of terminal 3. The size of core 8 corresponds to the volume taken up by terminal 3 and by the column of mercury 7. Then, molten wax is cast through aperture 2. When this wax has set into an insulating sheath, core 8 is withdrawn and the required amount of mercury (usually a small drop) is poured into the duct 6 left in the wax, care being taken that the mercury comes into contact with terminal 4 and overflows slightly at the opposite end of the sheath, so as to secure a good contact with terminal 3, as the latter is secured at the corresponding end of the tube.

It will be understood that, when the fuse is brought to a temperature corresponding to the melting point of the wax, the latter will melt and flow out through aperture 2; the column of mercury will then disintegrate, thus interrupting the current between the terminals.

It is not essential to provide an exit for the molten wax, because as the wax becomes fluid, the mercury, which is denser, falls to the bottom. Hence, use may be made of a plain tube without an aperture, as shown in Fig. 3. In this embodiment of the invention, the fuse comprises two cylindrical terminals 10—11 ending in conical tips, and a moulded or perforated sheath 12 of fusible material (Fig. 4) having a central cylindrical duct 13 opening into conical depressions 14—15, whose surface corresponds to the conical tips 16—17 of terminals 10—11. The column of mercury 18 is poured into the duct 13 and the whole is arranged in a cylindrical envelope 18 of insulating material, such as glass, china, etc.

The assembly of this fuse may be made as follows:

One of the conical depressions (18 for example) of sheath 12 is stopped by the corresponding terminal 10, duct 13 is filled with mercury, the opposite aperture 15 is then stopped by terminal 11 and the whole is inserted into insulating tube 19.

When the temperature rises above the melting point of sheath 12, the ends of this sheath, which are in contact with the terminals 10—11, and whose temperature rises faster than the middle portion are softened; the mercury will thus flow between the conical tips 16—17 of the terminals and the molten ends of the sheath, and a por-

tion of this mercury will collect in the small space 20, left between the tips of the terminals, the wall of the tube and the ends of the sheath, this breaking the mercury column 18 and interrupting the circuit.

In this embodiment of the invention, the insulating tube 19 may be made of a rigid material, or of a flexible material which is wound around the terminals 10—11 and sheath 12.

It will be seen that the breaking off of the circuit takes place progressively without giving rise to any important induction current.

Fuses according to this invention may be devised to operate at various temperatures, either by using insulating sheaths made of materials fusible at various temperatures, such as beeswax, paraffin wax, gutta, tar, etc., or by varying the mass of the insulating sheath, or the mass of the terminals, or the size of the movable or loose conducting member, or the shape of the fuse, or the heat conductivity of the surrounding tube. However, for a fuse of a determined construction and size, the operating temperature will be constant.

The column of mercury may be replaced by a small bar of conducting material, adapted to be supported by the insulating sheath and to fall down as the latter melts, thus causing interruption of the circuit.

Tube 1 may be of any suitable material, such as a suitably insulated metallic tube.

This fuse may be used in all kinds of electric apparatus, such as domestic appliances provided with heating resistances, whose prolonged heating, due for example to oblivion, may set fire to surrounding objects. It may as well be used to protect the apparatus itself: electric motor, wireless set, ignition element for an engine, etc., to be protected against overheating.

The fuse according to the invention may also be used for the protection of any suitable plant having an electric control, such as an engine, where overheating may be produced by any cause and, for example, the fuse may be installed at any suitable part of the plant, for instance in the cooling radiator of an engine, and on the current inlet circuit of the control member. The fuse, instead of being installed in the circuit of the electric apparatus, or of an electric control member, may be located in an auxiliary circuit connected with any suitable alarm device, either luminous or sonorous.

Finally, it will be seen that this fuse may operate under the action either of external heat due to heating of the whole of the plant, or of internal heat developed within the fuse by an increase of the current or the tension, the operation being adjusted by selecting the material used for the fusible sheath, or by varying the cross-section or the resistivity of the movable or loose conducting member.

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Fig. 1

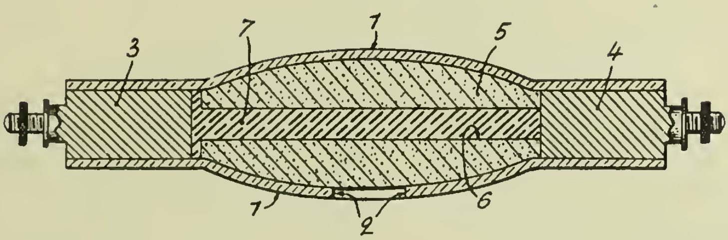


Fig. 2

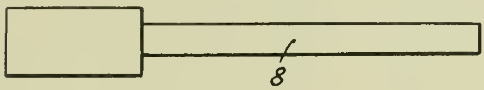


Fig. 3

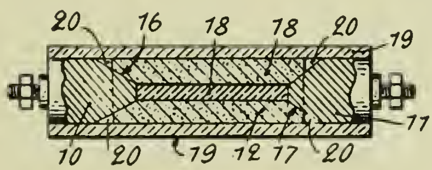
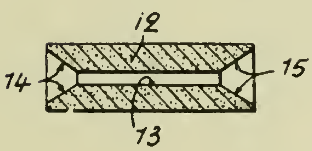


Fig. 4



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ALIEN PROPERTY CUSTODIAN

GAS COMPRESSING PLANT

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Application filed January 27, 1942

This invention has reference to plants for compressing gas under a high pressure and has for its primary object to provide a plant of this kind particularly utilisable for refilling with gas such as lighting gas compressed under suitable pressure steel bottles or tubes such as are employed either stationarily or for such uses as on board automotive vehicles for feeding internal combustion engines.

Another object of the invention is to provide an improved gas compressing plant by means of which steel bottle refilling may be completed within a few hours by an entirely automatic process carried out very gradually and requiring a minimum of supervision and labor.

A further object of the invention is to provide an improved gas compressing plant made up of a single or multiple low pressure unit and a single or multiple high pressure unit, said units being absolutely tight and mutually interconnected, the arrangement of the compression producing members being such as to provide slow operation and small delivery.

Another object still of the invention is to provide an improved gas compressing plant including fluid cooling means for the operative or movable parts performing the drive between a prime mover such as an electric motor and the low pressure and high pressure pistons, and further fluid cooling means for the outer surfaces of the stationary cylinder units in which said pistons are respectively moved responsive to rotation of said motor in periodically reversed directions.

Still another object of the invention is to provide an improved gas compressing plant or installation wherein cooling of the cylinder and piston units is assisted by those members such as rings and gasket-like leather cups ensuring proper fluid tightness.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel construction and combination of parts that will be now described with reference to the accompanying diagrammatic drawings exemplifying a suitable constructional form and a variation and forming a part of the present disclosure.

In the drawings:

Figure 1 is an elevational view with many parts in section showing the compressing plant in its entirety, certain details being omitted for the sake of clearness.

Figure 2 is a detail sectional view drawn on a larger scale showing the low pressure piston and the associated cylinder end.

Figure 3 is a detail sectional view also drawn on a larger scale and showing the high pressure piston with the associated cylinder end.

Figure 4 is a diagrammatic simplified view showing a modified arrangement in which the operation takes place hydraulically instead of mechanically.

Like reference characters designate like parts throughout the several views.

The frame of the compressing plant shown on the drawings comprises a top bracket 1 on which is supported an electric motor 2 of suitable power and characteristics which through a belt 2^a, a pulley 2^b and an intermediate shaft 2^c drives a gear 6 fast upon said shaft and meshing with cog teeth on a flange 3^a formed integral with an elongated nut 3 which is so connected lengthwise to the adjacent frame parts as to be held thereby against longitudinal displacement.

Inside the nut 3 whose internal screw thread may have any suitable pitch is engaged a horizontally extending screw-threaded spindle 4 adapted to be slowly shifted as the nut rotates. Said spindle is held against rotation by splining keys or feathers 5 wedged in the adjacent frame parts and slidably received in longitudinal grooves or keyways 7 formed in said spindle 4. Owing to this arrangement, and as will be readily understood, when the motor 2 rotates in the one or the other direction responsive to the operation of a reversing switch as will be described hereafter, the splined screw-threaded spindle 4 is longitudinally moved either to the right or to the left at the proper slow speed which is required for conveniently performing adequate operation of the compressing plant.

The ends of the screw-threaded spindle 4 are provided respectively with a low pressure piston 8 and a high pressure piston 9. Said pistons are housed for longitudinal motion in internally machined steel tubes or sleeves 10, 11 which form the compression cylinders. The cylinder 10 corresponds to the low pressure stage, while the cylinder 11 which is of much smaller cross sectional area corresponds to high pressure stage. Said sleeves or cylinders 10, 11 are tightly closed at their outermost extremities by end plates 12, 13 respectively. The end plate 12 of the low pressure compressor (Fig. 2) is provided with a spring-urged suction valve 14 and with a spring-urged delivery valve 15 controlling the outlet to a low pressure delivery pipe 15^a. The valve 14 similarly controls the inlet through a suction pipe 14^a. The end plate 13 of the high pressure compressor (Fig. 3) is provided likewise with a high

pressure suction spring-urged valve 16 controlling the inlet through a suction pipe 16^a and with a high pressure delivery pipe 17 controlling the outflow through a delivery pipe 17^a. The fluid circulation takes place as depicted by the arrows.

The low pressure delivery pipe 15^a and high pressure suction pipe 16^a are connected to an intermediate tank 40 which may be of any known form and which thus provides intercommunication between the cylinders 10, 11.

All the movable parts of the operating mechanism are immersed in a pool of oil or equivalent liquid enclosed in an overhead central or primary container 21 while the stationary parts of the plant are cooled either by a mass of water 22^a enclosed in an elongated vat or secondary container 22 supported by uprights 22^b as shown in Fig. 1 or, alternatively, by strong ventilating means (not shown) which may be of any conventional construction.

It will be understood that at each reciprocating motion of the spindle 4 the oil is driven out of the piston chamber of the cylinder 10 or 11 and flows back into the central or primary container 21, whence it is introduced into the opposite piston chamber of the other cylinder, and so forth, thereby ensuring a continuous oil stirring and circulating action which facilitates heat exchange and cooling.

Owing to this arrangement and to proper use of well cooled gasket-like leather cups as hereinafter described, it becomes possible to give the pistons proper fluid tightness which, in cooperation with the provision of the tight suction and delivery valves, ensures the proper drawing in of very small quantities of fluid at a time and their correct deliveries under suitable building up pressure.

The arrangement of the gasket-like leather cups is advantageously as follows in order to protect them from undue heating and the consequent damage which might ensue therefrom:

As shown in Fig. 2, the low pressure piston 8 is made hollow so that the oil pool in which the movable parts of the mechanism are immersed may adequately cool it from within. Moreover, the piston 8 is provided at the front end of its skirt with a plurality of heat exchanging rings 23, two of which are provided by way of example in the constructional form shown.

As the high pressure piston 9 (shown separately in Fig. 3) cannot be made hollow as otherwise its recesses would not be sufficient to enable the heated oil to flow away, said piston is provided with a larger number of heat exchanging rings such as 24. In the constructional embodiment shown, six of these rings 24 are provided. Moreover, the rod of said piston has a cross sectional size matching that of the cylinder bore so as to assist cooling owing to conductiveness.

As a means of safety, two or more leather cups such as 25 may be arranged one after the other in the direction in which pressure exerts itself. Moreover, on both pistons, for low and for high pressure operation respectively, an additional leather cup 26 is so arranged as to extend in the opposite direction, thereby constituting an oil-tight gasket.

The leather cups fitted on the skirt of the low pressure piston 8 shown in Fig. 2 form an integral body having a splayed outline and comprise a common inner retaining flange 25^a clamped home between an inner collar 8^a on the piston skirt and a counter-elbowed keeper ring 8^b, bolts 36 being engaged through coincident holes in said collar and ring.

The reciprocatory motion is obtained as shown in the drawings by reversing the current feed to the electric motor 2. To that effect, a nut member 27 splined on a rod 28 so as to held against rotation is associated with a screw-threaded rod 29 with a view to following the movements of the low pressure piston 8. At the end of its stroke said nut member 27 operates either of a pair of oppositely disposed contact studs 30 which are so wired in a conventional way (not shown) as to reverse the current feed to the electric motor 2, whereby the direction of rotation of its shaft is reversed and the screw-threaded spindle 4 rotates in the opposite direction.

Each cylinder unit may be duplicated or multiplied so as to form a composite assembly whose cylinders may be juxtaposed side by side, the reversing and reciprocating mechanism being then common to all cylinders. This modified arrangement will be readily understood by anyone skilled in the art and does not require special illustration. The expression "cylinder unit" used in the claims will be meant to also involve this constructional modification.

Control of the operation may be performed either mechanically as in the above described constructional example or hydraulically. Where the cylinders would be arranged vertically instead of being mounted horizontally, the pistons may be replaced by a mass of liquid so enclosed in a container as to alternately rise and sink therein under the pushing stress exerted by a plunger or like actuator. This constructional modification is diagrammatically illustrated in Fig. 4 wherein 31 designates the plunger adapted to move upwardly or downwardly in one upright leg 34 of a U-shaped liquid container whose other upright leg 35 is provided on its side wall with a suction valve 32 and at its top end with a gas delivery valve 33. In this constructional modification, the plant may also comprise one or several pressure stages.

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BY A. P. C.

B. R. PLANCHE
GAS COMPRESSING PLANT
Filed Jan. 27, 1942

Serial No.
428,380
2 Sheets-Sheet 1

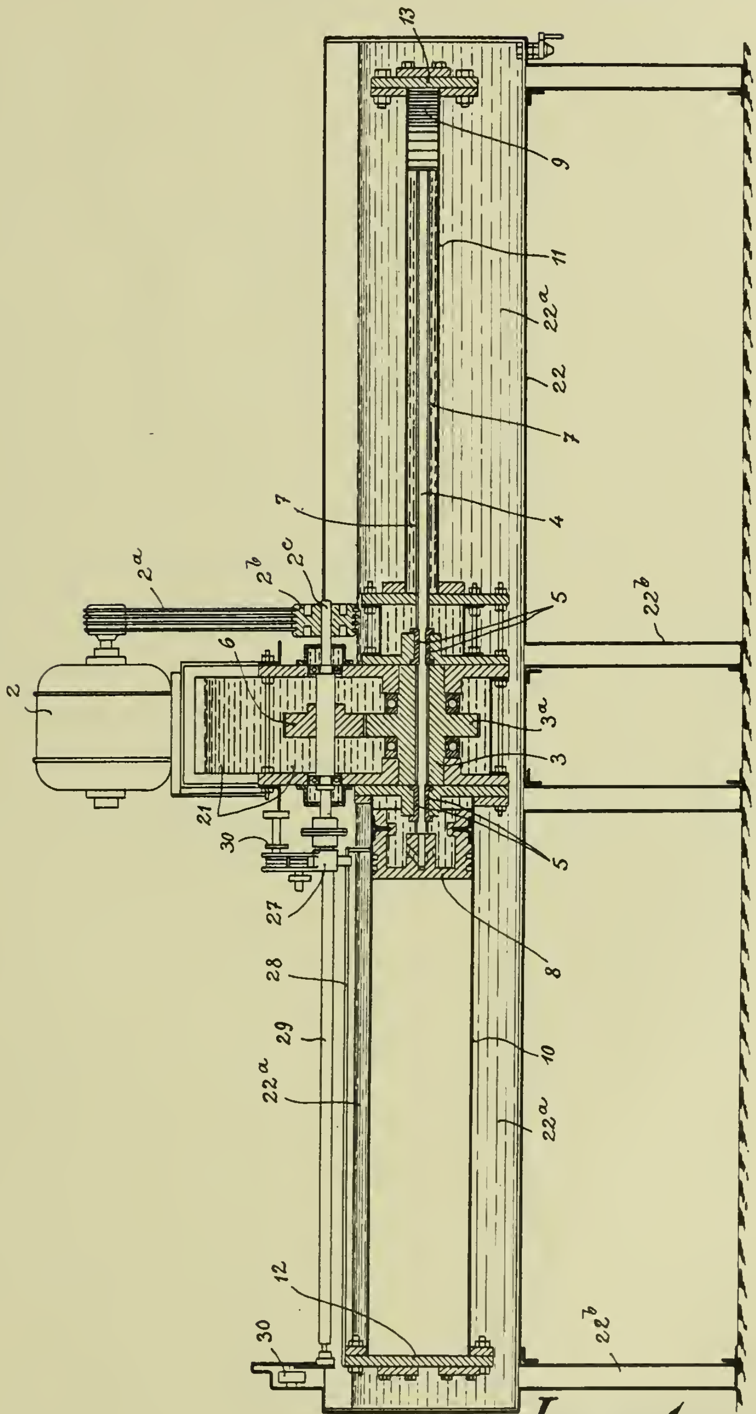

Fig. 1

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Fig. 2

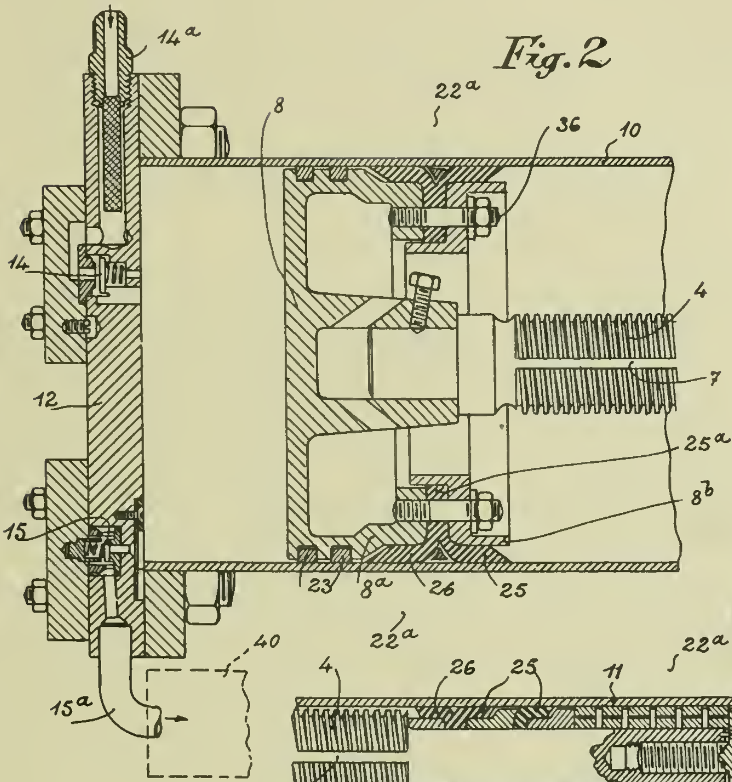


Fig. 3

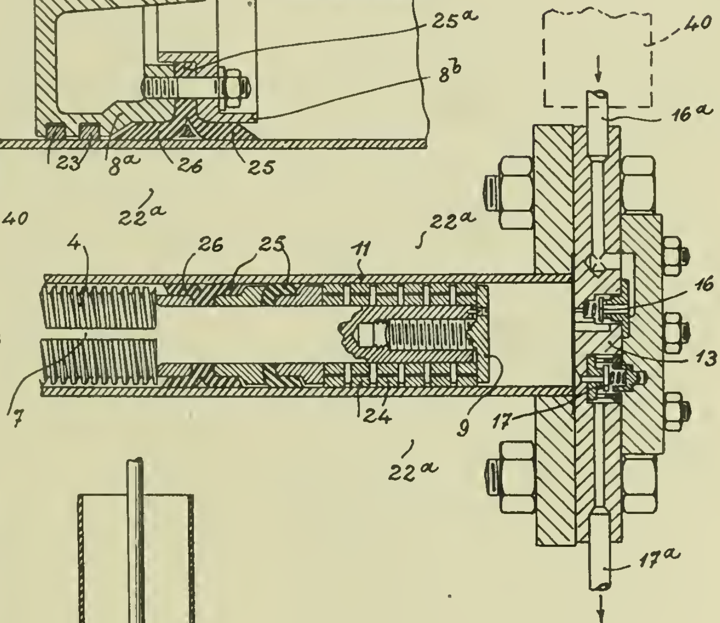
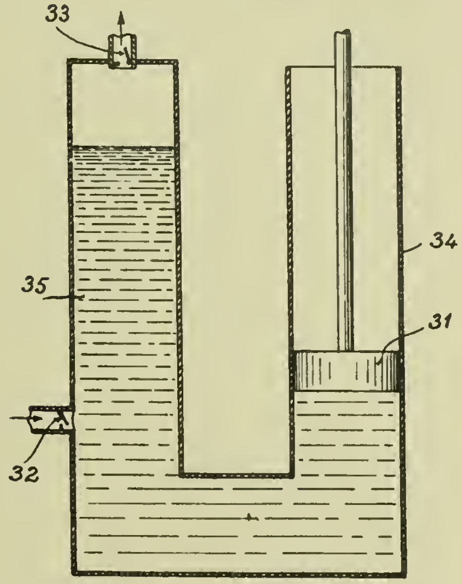


Fig. 4



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ALIEN PROPERTY CUSTODIAN

TELEVISION METHODS AND SYSTEMS

Henri de France, Lyon, France; vested in the Alien Property Custodian

Application filed February 4, 1942

The present invention relates to television methods and systems and more especially those in which the synchronization of the images is obtained through the transmission of synchronization signals mixed with the image modulation, so as to synchronize, at the receiving station, the scanning of the lines and of the images.

The chief object of the present invention is to provide a method and system of the type above referred to which are better adapted to meet the requirements of practise than those used for the same purpose up to the present time.

According to an essential feature of the invention, I distinguish the different kinds of synchronization signals (to wit, line synchronization and image synchronization signals) no longer, as it has been done prior to my invention, by differences of amplitude and duration, but by a frequency modulation of the carrier and, in a particularly simple embodiment of the invention, by a mere change of the carrier frequency during the time of transmission of the image signals.

This feature is advantageous in particular in that it permits of maintaining the line signals while the image signals are being transmitted and thus of maintaining the precision of scanning at the receiving station.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatical view illustrating the transmission of television image signals, according of the principle of the invention;

Fig. 2 is a diagram of a system for carrying out this principle, according to an embodiment of the invention.

As above stated, the invention which will now be described in a more detailed manner is intended to improve the synchronizing of scanning between the transmitter and the receiver, in a television system, by transmitting line and image synchronization signals, according to a general method which is known.

In the systems of this kind used up to the present time, two different kinds of signals are used, which generally occupy about thirty per cent of the maximum amplitude of the total modulation, while only the image modulation varies from thirty to one hundred per cent.

Furthermore, according to these known systems, the line synchronization signals are distinguished from the image synchronization signals by their length or duration, which is considerably greater for the last mentioned kind of signals. At the receiving station, use is made of circuits having different time constants for separating the two kinds of signals, after filtering of the image modulation by a detecting or limiting device of any suitable type.

Experience has taught that this method of transmission does not permit of obtaining a sufficient precision of scanning, especially when the scanning is effected in the so-called "interlaced line" manner, because, in this last mentioned case, the precision must be extremely high if a correct interlacing is to be obtained.

The lack of precision is due in particular to the fact that, on the one hand, the line signals are not transmitted while the image signal is being transmitted, and, on the other hand, the beginning of the image signal is defined but rather softly by the time constant circuits of the various types existing at the present time.

In order to obviate these drawbacks, according to the present invention, the image synchronization signals are transmitted with characteristics different from those of the line synchronization signals so that it is possible to maintain said line synchronization signals while the image sigals are being transmitted.

For instance it suffices, for this purpose, either to form the image signals by a frequency modulation of the carrier frequency of the television transmission, or, more simply, as it will be hereinafter supposed, in the following examples, by a sharp variation of this carrier frequency, lasting for the whole time of transmission of each image synchronization signal.

Preferably, the change or variation of frequency of the carrier will be chosen of relatively small value, for instance of the order of magnitude of 500,000 cycles, so as to permit of remaining within the frequency band of several megacycles that is necessary for the image modulation at the receiving station.

Such a modification of the frequency will not give rise to any detected current in a normal detector and, on the other hand, will not change anything to the conditions of operation of the circuits through which the line synchronization signals are to be received.

Of course, the receiver will include all the elements necessary for detecting the special frequency of the image signals, or, in a general manner, all the means necessary for producing, in said receiver, in response to image signals trans-

mitted in the manner above described, the signals, of any conventional or other kind, capable of correctly controlling the scanning and synchronizing of the images.

Of course, there are many possible embodiments of such a system, among which the following will be described, by way of example:

According to a preferred arrangement, which may, eventually, be used separately, the transmitter includes the following elements:

a. Two oscillators I and I' (Fig. 1), working, respectively, the first with a frequency n to be used for the transmission of image synchronization signals, and the second with a frequency n' to be used during the transmission of the images, it being well understood that these transmitters might be devices other than oscillators, provided, that they give the same result; and

b. For passing from the operation of one to that of the other, a control device itself influenced by the image synchronization signal, itself produced in the usual manner, this control device being capable of working instantaneously, that is to say practically without time constant, and being, for instance, adapted to produce, in a suitable manner, the synchronizing of the tubes of oscillators I and I'.

In said Fig. 1, I have diagrammatically shown a television transmitter made according to the invention.

The various amplification stages of the transmitter are shown at E^1, E^2, E^3. The image modulation signal is produced by an iconoscope Ic. The usual line and image synchronization signals are produced multivibrators or relaxation oscillators, for instance of a known type, l and i, suitably synchronized in such manner as to ensure that the ratio of the respective transmission frequencies of the line and image synchronization signals is ensured, and maintained.

These last mentioned signals are mixed with the image modulation, at M, and the whole is caused to modulate, for instance, the last amplification stage E^3. Furthermore, and this is a particular feature of the present invention, the signals produced in i are caused to influence control device S, in such manner as to control the passage from frequency n to frequency n' or inversely.

Concerning this device S, it includes for instance a powerful potentiometer (that is to say of high power and low resistance), in combination with tubes mounted as shown or in any other way so as to obtain, at the output end, a polarization voltage which starts one of the oscillators and a blocking voltage which stops the other oscillator, these two voltages being temporarily interchanged when an image synchronization signal is being transmitted, after which they immediately return to their prior values, and so on.

Said device, according to the embodiment shown by the drawing, includes four vacuum tubes, to wit **2**, **3**, **4**, **5**.

Tube **2** receives the signal in the form of a voltage V variable as a function of time T, the signals being emitted for instance at the rate of 50 per second. It is normally blocked by a high polarization, point A being then at the same potential as the point B of the potentiometer, that is to say a high potential.

Tube **3** has its control grid connected to the output end A of tube **2** and the same is true of tube **4**. Therefore, when tube **2** is blocked, a normal current flows through tubes **3** and **4**.

Finally, tube **5** has its control grid connected at C' with the output of tube **4**. Owing to the presence of a resistance r^2, this point C' is brought to a highly negative voltage when current flows through tube **4**. It follows that said tube **5** is, under these conditions, blocked.

It will already be seen, from what has been above stated, that, under normal working conditions, that is to say during the time interval t between two signals, considering, at the output ends of tubes **3** and **5**, respectively, two points C and D connected, respectively, to a point O of voltage equal to zero (or an intermediate voltage, which may even be positive) through resistances r^3 and r^4, I obtain, on the one hand, at C, a highly negative voltage and, on the other hand, at D, a voltage equal to zero (or in any case equal to that of point O). The tensions that are respectively utilized for polarizing oscillators I and I' permit of bringing into action the one I' that serves to the transmission of the images, while oscillator I remains blocked.

It will be easily understood that, under the effect of a signal transmitted from l, tube **2** is released and point A becomes highly negative under the effect of a resistance r^1. It follows that tubes **3** and **4** are blocked and that, on the contrary current flows through tube **5**. The conditions above described are reversed and oscillator I is started for the short time interval corresponding to said signal, while, during this time, oscillator I' is on the contrary blocked.

As for oscillators I and I', they may be of any suitable type.

In Fig. 2, these oscillators include each two tubes, **6**, **7** and **6'**, **7'**, respectively, the second of which, to wit **7** or **7'** has its grid polarized by the above described device, said grid being connected to point C or D, preferably through voltage adjusting means.

At **8**, I have diagrammatically shown the input end of the transmitter proper which will permit, through amplification, frequency multiplication and modution means, known in themselves, of transmitting the image modulation accompanied by its synchronization signals.

As for the receivers capable of receiving from systems such as that above described, they must first include, concerning the circuits for reconstituting the image and those serving to distinguish the line synchronization signals, any suitable means, of a conventional or other type.

For the reception of the image synchronization signals, said receivers are provided with means for selecting frequencies, such means utilizing for instance frequency modulation receiving arrangements, that is to say, for instance, arrangements including: a saturation circuit capable of bringing back the amplitude to a constant peak level whatever be the frequency, and a frequency filter stopping a band of amplitudes when the frequency passes from n to n' or inversely.

Then it suffices to have recourse to a polarized two electrode separators or the like for obtaining a signal only for the amplitude corresponding to the frequency n that is utilized during the transmission of the image synchronization signal, after which it is possible, by means of any known device, to reconstitute the usual image synchronization signals according to the result of this detection.

Any way, whatever be the particular embodiment that is chosen, I obtain a system the operation of which results sufficiently clearly from the preceding explanations for making it un-

necessary to enter into further description thereof.

This system has, over those existing at the present time and used for the same purpose, the following advantages, among others:

a. It permits of maintaining the line synchronization signals while the image synchronization signal is being transmitted;

b. It ensures a sharp start of the image synchronization in the receiver, since the time constant brought into play in this operation is at most equal to that of a filter capable of separating frequencies n and n' which are very close to each other, or to that of a frequency modulation detecting circuit, which time constants can easily be made much smaller than the length or duration of a line synchronization signal.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

HENRI DE FRANCE.

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H. DE FRANCE
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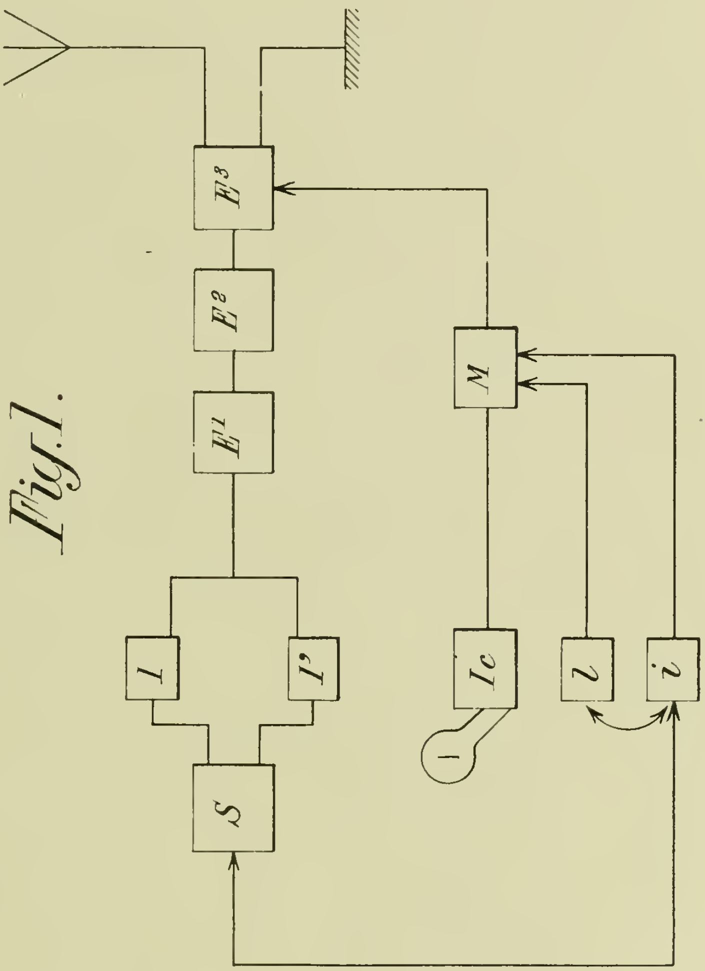

Fig.1.

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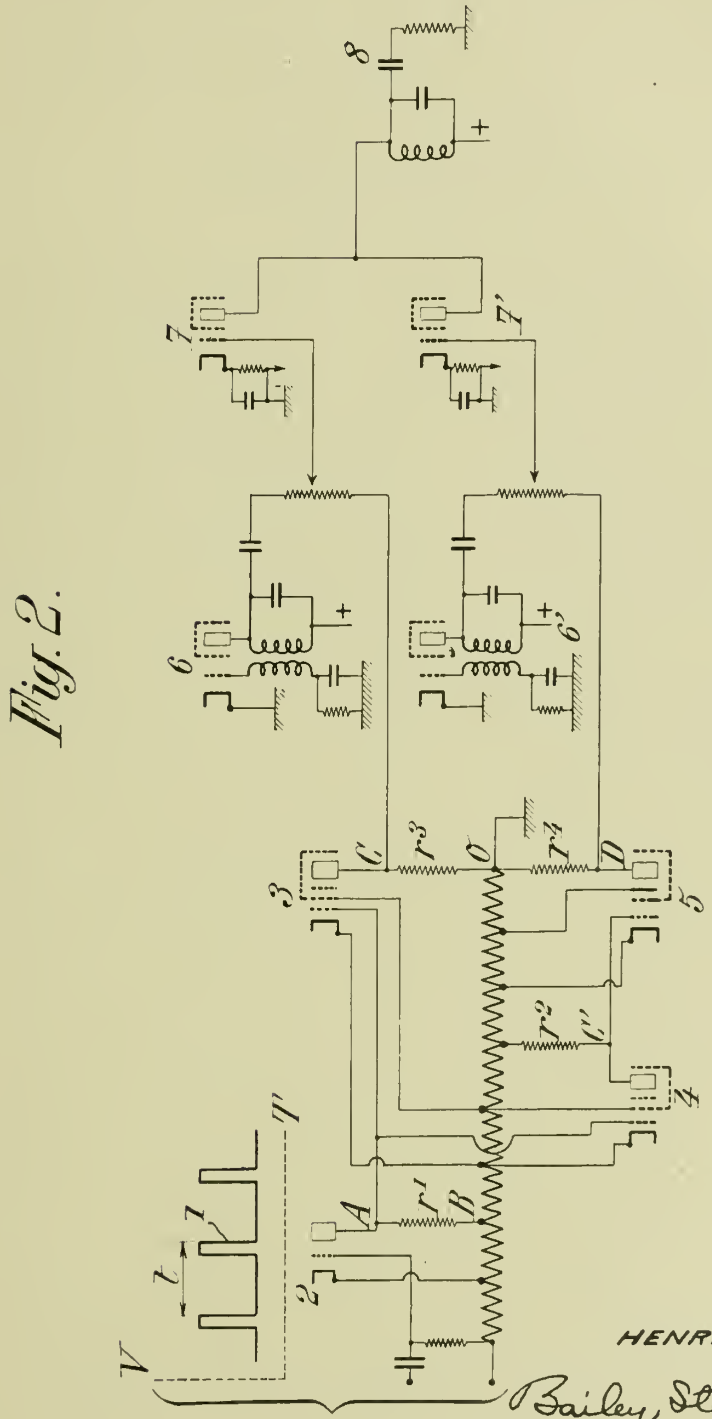

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ALIEN PROPERTY CUSTODIAN

BLACK SPOT CORRECTING MEANS

Richard Ritter von Felgel-Farnholz, Teltow-Seehof, near Berlin, Germany; vested in the Alien Property Custodian

Application filed February 12, 1942

My invention relates to television systems and particularly to television systems of the type in which a cathode-ray transmitter tube using the storage effect is employed.

It is well known that, in television transmission systems comprising cathode-ray transmitter tubes using the storage effect, there will occur, in the picture received, visual disturbances which become manifest in an irregular distribution of brightness within the scanned area. This phenomenon of irregular brightness distribution will be particularly distinct in cases when the light-sensitive layer is everywhere illuminated with equal brightness. For example, one corner of the picture may be of a very dark shade, while the corner diagonally opposite may be of a very light shade. This phenomenon is commonly referred to as "black spot."

It is, accordingly, an object of my invention to provide a method of and means for correcting, or otherwise controlling, the shading of a television picture.

It is a further object of my invention to provide an improved method of and an improved means for preventing the transmission of undesired signals from the picture transmitter.

In accordance with the invention, in a cathode-ray transmitter tube serving for the transmission of television programs and the like, the intensity of the electron beam scanning the storage electrode is so controlled that the picture modulation effected by the intensity control will be directly opposite to the picture modulation producing the black spot, so that, at the output of the cathode-ray transmitter tube, a picture signal practically free from disturbing signals is obtained. It is advisable to effect the modulation of the electron beam scanning the storage electrode by means of a perforated diaphragm, preferably the Wehnelt cylinder. For this purpose a modulating potential is admitted to the beam modulating electrode, said potential being advantageously generated by means of signal generators whose output currents are mixed with one another across control elements.

Other objects, features and advantages of my invention will appear from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a circuit and block diagram of a television transmitter embodying my invention.

Fig. 2 shows the undesired black spot at the television receiver.

Referring to Fig. 1, an optical image of object 1 to be teletransmitted is produced, by means of optical system 2, on storage electrode 3 of a cathode-ray transmitter tube 4 of the type described in an article by V. K. Zworykin published in the January, 1934, issue of the Proceedings of the Institute of Radio Engineers. Within that tube an image of electrical charges is generated, said charges corresponding, in their respective distribution, to the brightness distribution of the scanned object. The charge stored on the storage electrode is taken off by means of an electron beam generated in a gun comprising a cathode 5, a Wehnelt cylinder 6 and a first anode 7. Under the influence of the deflecting voltages supplied to pairs 8 and 9 of deflecting plates the scanning beam is moved line by line across the storage electrode.

The intensity of the scanning beam can be varied by means of electric control signals, which are applied to Wehnelt-cylinder 6.

Said electric control signals of suitable form and frequency are fed to the Wehnelt cylinder across line 10, the phase of said signals being so chosen and their amplitude so dimensioned that the disturbing spurious signals otherwise resulting at the output of the cathode-ray transmitter tube will be balanced out and disappear for this reason. By means of a mixing device 11 which may serve also for coupling purposes the electric control signal is composed of auxiliary signals. The auxiliary signals are generated by means of signal generators 12, 13, 14, and 15 which generate e. g. saw-tooth curves of picture frequency according to curve 12*a* and such of line frequency according to curve 13*a* as well as sine-shaped half-waves of line frequency and picture frequency according to curves 14*a* and 15*a*. Furthermore, a variable modulating device 16 has been provided, in order to modulate the amplitude of the saw-tooth oscillations produced by generator 13, in the rhythm of the line frequency (i. e. in proportion to the amplitude of the signals represented in curve 12*a*).

In certain cases, especially when the disturbing signals have a considerable amplitude so that, for compensating the black spot, the electron beam which effects scanning must undergo a relatively high degree of modulation, it is of advantage the gain of at least one stage of the picture modulation amplifier may be varied. The amplification should be controlled in dependence of the amount of the compensating voltage required at any particular instant. Thus the gradation curve of the picture received will be practically the same at all spots of the scanned area of the picture and independent of the disturbing signal

amplitude which is characteristic for the respective picture spot as well as independent of the modulating voltage amplitude required for compensation.

The causes of the so-called black spot have not been completely explained as yet; probably it is caused by an irregularity of the spatial charge cloud being developed in the surroundings of storage electrode **3**. This irregular distribution may result from the gravitational field of the earth and from the leap in potential resulting at the discharge of each of the storage elements. Often, there will arise a disturbance effect as per Fig. 2, i. e. the storage electrode being uniformly illuminated, e. g. the area near the left and the upper edges of the picture surface is being illuminated brighter than the area near the two other edges. For compensating this form of the black spot signals according to curves **12*a*** and **13*a*** are mixed and applied to Wehnelt cylinder **6**.

RICHARD RITTER VON FELGEL-FARNHOLZ.

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R. R. VON FELGEL-FARNHOLZ

BLACK SPOT CORRECTING MEANS

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FIG. 1

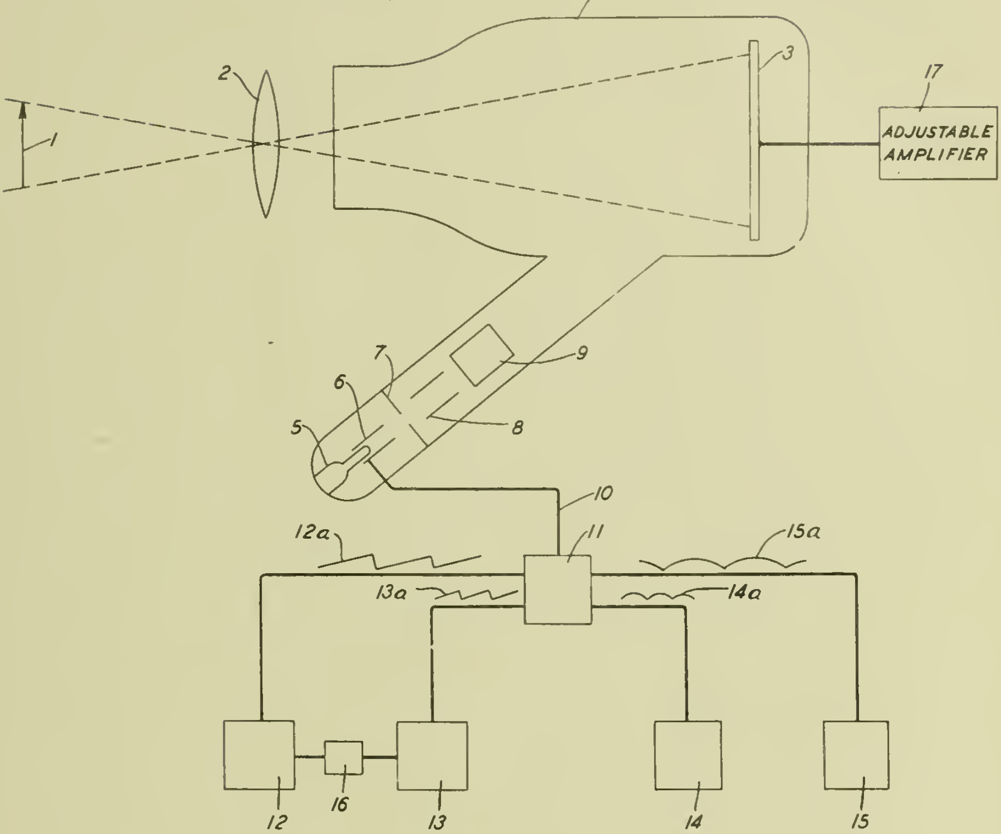
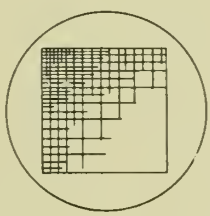


FIG. 2



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ALIEN PROPERTY CUSTODIAN

BAND WITH GUSSETS TO OBTAIN BY CASTING CONSTRUCTIVE JOINTING ELEMENTS DIVIDING THE CHARGES BY DISPERSION OF THE THRUSTS

Jacques Couëlle, Marseille, France; vested in the Alien Property Custodian

Application filed February 26, 1942

Experience has shown up that a rigid material won by casting, cement or others, works on the mass of its aggregate without the elasticity useful intervening in the very moment of an effort causing a flexion, which effects to a breaking of this material.

It is owing to this constatation that has been thought to join to this rigid material a resistant element which at the same time presents flexibility: thus the armed cement beams have been created, widely used now-a-days. However, it also has been shown up, that the construction of a flooring with armed beams, asks, besides of a specialised worker, also for a certain quantity of iron, which raises the weight of the flooring and, not the least, its prime cost. To this there must be as well added the difficulty which still may be met in certain cases, to procure iron; consequently it can be presumed, that the armed beam, in spite of its incontestable qualities, gives certainly some difficulties of realization. These are now eliminated by the object of the present invention, which consists in an elastic band, provided with gussets, properly arranged to form grappling surfaces and abutments between the elements in casted material, be cement, plaster or others; the fields of which thus separated by the thickness of the band, fit however the one into the others, following the wanted profiles, to realize a homogeneal and extremely resistant whole, though formed by separated elements.

The goal of the invention and its characteristic is to practically realize bearing surfaces without utilisation of iron. The band and some of its applications, is represented on the annexed sketches, which shall at the same time explain and demonstrate the object of the invention.

Up to these sketches:

Pitcures 1 and 2, essentially schematical, showing the principles of the invention.

Picture 3 in perspective, shows the elastic band, object of the invention.

Picture 4 in a smaller measure, shows different ways of utilisation of the band as shown in Pic. 3.

Picture 5 showing in traversal cut, a surface, a bearing surface, constructed up to the invention.

Picture 6 is also a transversal cut of a bearing surface curved.

Picture 1 shows a solid I, which forms a beam, only formed by molecularly contact of a stuff known as such or cement; this beam, thus constructed, will not give any other resistance towards efforts or shocks, which it may have to support, following the directions A and B, than that, rather weak, of the very cohesion amongst themselves of these molecules. But if now we construct this same beam, as shown on Pic. 2, in several pieces **2**, **3** and **4**, and if we give to each of these pieces' extremities parts **5**, with adapted dips in order to create a sort of wedges, the result of these beams are completely changed; for it can be observed that, in charging these new beams, following always the sense of the indications A and B, reaction will result on the surfaces of the inclined parts which works on the compression; owing to this fact the work of the resistance of the molecules is changed because the efforts, be of the weight, be of a shock, now are divided not only on one element, as shown in Pic. 1, but on three elements, each of which works in a different direction and varied direction. We can say, that thus a force-motor has been realized by this fragmentary division of the field of effort; in fact, this means the industrial utilisation of the phenomenon which takes place in the nature and which can be observed with structure of the ceilings of grots, or quarries with subterranean galleries, where the superior part is forming a sort of ceiling, sometimes very big surfaced, maintains by itself through "failles" in the stratification of the whole, which act in the same way as the fragmentation of the beam, shown on Pic. 2.

This fragmentation industrially is obtained by the object of this invention which consists in a band **6**, shown on Pic. 3.

This band has gussets **7** and **8** of hollows opposed and disposed in quincunx; this band can be made in thin metal, from cartoon or any other possible material, and even from strong paper. The openings **9** allow the passage of the bands **10**, Pic. 4, which by their tension will allow to maintain the band **6** in the wanted and different forms, some of which are also shown in the same picture.

This band at the same time realizes the isolation of the surface casted in lines of division of the charges, effort and qhoxk, and the intimate union by fitting of the separated lines, as shown in Pict. 5 and 6.

These fittings are essentially obtained by the disposition and forms of the gussets **7** and **8** which create very wall inclined surfaces forming as many wedges or failles of junction as there will be casted elements. It is therefore incontestable, that all efforts, resulting from initial weight, use and the shocks which will produce in direction of the arrow A or direction of arrow B, will always be carried by the inclined parties **7**,

and in the opposite direction 8, forming as many tenons of grappling and force, which hinders all break of the molecules, at the same time giving way to the normal flexions, assuring elasticity of the whole and its conservation.

This disposition may be used with all its qualities of resistance and lightness to construct partitions, as well as vaultings, Pict. 6, furthermore for constructing basins, reservoirs and other similars.

The industrial result, obtained with the band, which is the principal object of this invention, is considered to be new because now bearing surfaces of repartition in all directions of the pressure and charging can be constructed, which are used for flooring, walls and covers.

The procedure of establishment of these surfaces is the same as for a flooring or a wall in armed concrete; to begin with there will be made a frame on which will be put the band 6 in the wanted form and kept by the bands 10, Pict. 4, then the cast of the chosen material will be dealt with as always.

After dessication of the whole, the frame will be taken away and the flooring, wall, partition or cover are ready to get the habitual coating.

Recapitulation

Band with gussets to obtain by casting constructive elements jointing, dividing the charges by dispersion of the thrusts, characterized only by an elastic band of metal, cartoon, moulded materials and even paper. This elastic band has the particularity to possess gussets in form and size according to the results wanted. These gussets are essentially disposed in quincunx and their openings are in opposite way towards the faces of the band.

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BAND WITH GUSSETS TO OBTAIN BY CASTING CONSTRUCTIVE JOINTING ELEMENTS DIVIDING THE CHARGES BY DISPERSION OF THE THRUSTS

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Fig. 1.

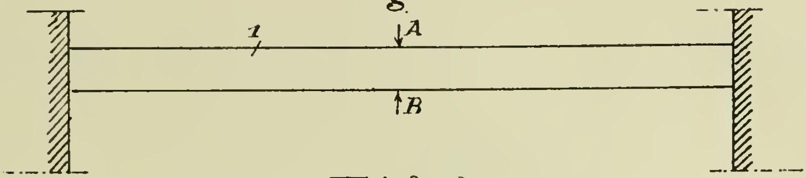


Fig. 2.

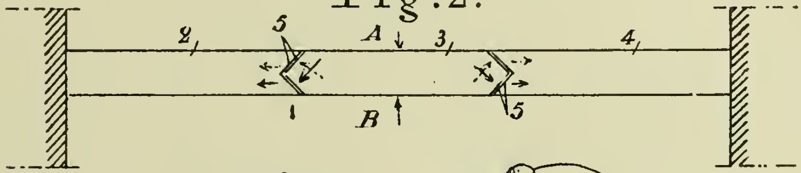
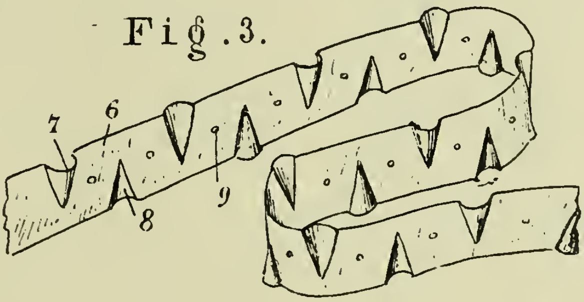


Fig. 3.



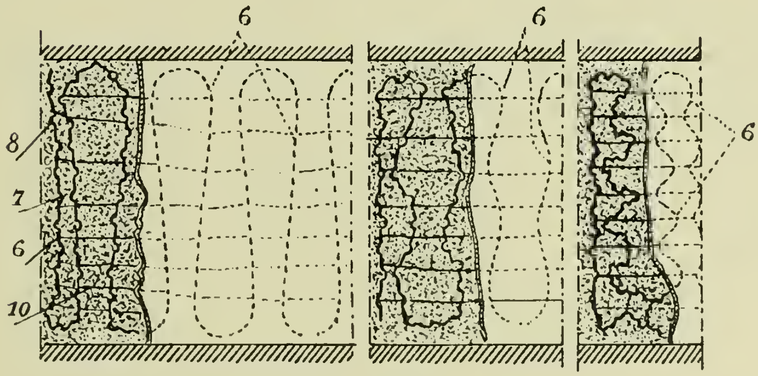


Fig. 4.

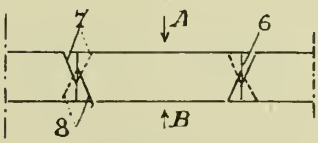


Fig. 5.

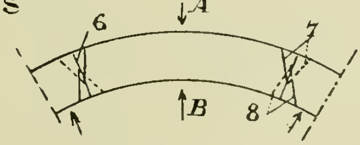


Fig. 6.

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TUBULAR ELEMENTS USED IN DWELLING CONSTRUCTIONS AND SIMILAR

Jacques Couëile, Marseille, France; vested in the Alien Property Custodian

Application filed February 26, 1942

The object of the present invention consists in improvements made to the known tubular elements or materials.

These improvements made to the tubular elements, preferably those made out of stretched clay are essentially structural; They aim only to the extension of the use of tubular elements, rather in light constructions, and more particularly to the effect of radiation of heat or cold by the walls of the houses where they are applied. This they realise, as other uses adapted to their qualities.

These results, considered as new in the art of architectural and industrial construction characterize the new invention.

The modified tubular elements, and some of their chief applications, are shown by the annexed drawings.

From these drawings:

Figure I represents, with cut parts, the mounting and assemblage of the modified tubular elements.

Figure 2 shows, at a smaller scale, the basis of a construction making use of the new element.

Figure 3 shows the summit of a construction using the new element.

Figure 4 represents, shown in traversal section, the use of these same tubular elements in the establishment of a beam.

Figure 5 shows a side view of a part of the beam shown on Fig. 4.

Figure 6 shows, respectively and schematically two forms of light constructions, more particularly established with the perfectioned tubular element.

The tubular element I shown on Fig. I and following is made preferably out of streched clay; it admits of a bell-mouthed collar **2** in its upper part, as principal modification.

Orifice **3** of this collar now allows communication between each one of the elements I, while the collar of the tubular elements known of the described element is closed, either by manufacture, or at mounting, or by an ergot or plug. This disposition of a stopped collar forbids the use of these tubular elements for radiation.

By his exterior shape, the same collar **2** allows the constitution of a cavity who may receive the material **4** of fixation and will thus form, by an illustrated comparison, rather exact, nevertheless, a "bamboo knot" who will permit giving to the elements I inclined positions, able to be solidly maintained, as the one shown in dotted lines on Fig. I, and whose uses are numerous.

In order to increase still more the adhesion of the material or of the plaster of fixation who may cover the elements I, these now have hooking grooves **5**.

These grooves may have different profiles and directions, always appropriated to their destination.

In the example shown on Fig. 2, collar **2** penetrates into socle **6**, which is preferably made of masonry, in which is essentially reserved a duct **7**, in which aperture **3** opens. This duct **7** is joined, according to the season, to a source of heat, such as a well, and it is thus that each one of the tubular elements I communicates with the others by the orifice **3**, thus forming radiating surfaces.

The hot or cold fluids get out by the ridge elements **8**, shown on Fig. 3, and whose superior orifice **9** may be obturated or recovered by a half-round tile (not shown on the drawings) who maintains the air in the elements, thus creating a natural atmosphere and impeding rain from entering the elements I. Nevertheless, if this should happen, the water would go out normally by duct **7**.

It is to be considered that the shape of the collar **2** and the reduced diameter of orifice **3** occasion an acceleration with turbulence of the natural draught established between base conduct **7** and ridge orifice **9**.

This intense circulation of heat or coolness is to the greater advantage of the conditioning effects.

These same elements may be used with all their qualities in the establishment of tubular beams, preferably in ceramics, shown in Figs. 4 and 5, where we see again in the walls **10** the conduct **7**, permitting the heating or the refrigeration of the ceilings and of the floors formed by this disposition of the beams, as of the walls, partitions and partition walls.

The examples of construction shown schematically in Fig. 6 with abutments or without, are those on which tubular elements generally apply themselves.

But these examples are not limiting, as it is comprehensible that with such elements, orientable in all directions, while staying water-and steam-tight, these may be used, not only in the construction of dwelling houses, but still to build bridges and similars, tunnels, silos, as well as atmospheric condensers, filters and underground canalizations for protection of electric cables and wires, gas condensers or similar. They can equally be used as drainages or ventilation elements

used in agriculture, and, lastly, in all places where it is useful to have protected conducts or very resistant hollow surfaces susceptible of being heated or refrigerated.

By the results obtained, considered as new, a progress estimated important in the art of construction is realized, as these elements, made out of a poor material, such as clay, permit constructing rapidly, without changing its shape, and with a minimum of cost, not only hutments, but walls and floors with thermic radiations, bridges, tunnels, heating apparatus, etc., in which no elements susceptible of being limitated, as iron or wood enter. Thus, the construction of shelters presenting all hygienic conditions and comfort will be able to go on without stopping and so receive those who now have none, because of actual events.

It is comprehensible that the shapes, the dimensions and the mounting disposition may change without altering in any way the general idea of the invention which has just been described, nor its industrial result which is to obtain with tubular elements walls of every shape and all applications assuring both resistance and insulation.

Summary

Improvements to tubular elements used in dwelling and other constructions, characterized by:

I° A tubular elements in streched clay having a collar bell-mouthed towards the outside, and perforated by an orifice equally bell-mouthed, but towards the inside.

This collar having externally hooking grooves for the adhesive materials.

2° A tubular element having at one end a collar for orientation mentioned in paragraph I. This tubular element having preferably exterior longitudinal grooves and onterior circular grooves. Both to facilitate the hooking on of the material uniting these elements.

3° A base- or support-element, preferably masonry, with an interior conduct into which opens the orifice of the collar mentioned at Paragraph I.

4° A ridge element into which opens the tubular element. This element having an opening for exhaust of hot or cold fluids circulating inside the surfaces constituted by the assemblage of the tubular elements identical to the one mentioned paragraph 2.

5° The combination and the cooperation of the elements above mentioned and described to obtain, firstly, constructions with radiating and bearing walls; and, further, water and steam-tight conducts for protection, even underground, drainages used in agriculture, and, generally, all applications where the claimed tubular element may be used or applied.

JACQUES COUËLLE.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

J. COUËLLE

TUBULAR ELEMENTS USED IN DWELLING CONSTRUCTIONS AND SIMILAR

Filed Feb. 26, 1942

Serial No.

432,393

Fig.1.

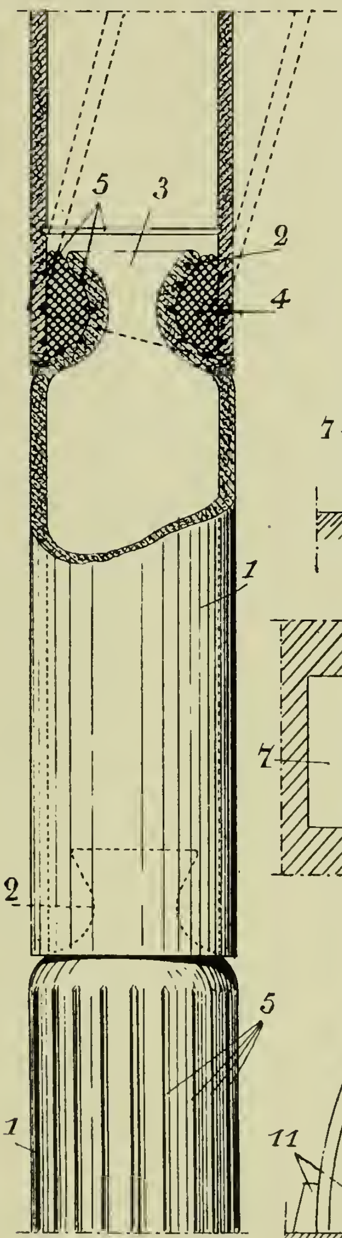


Fig.2

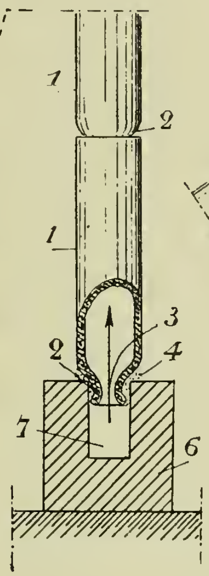
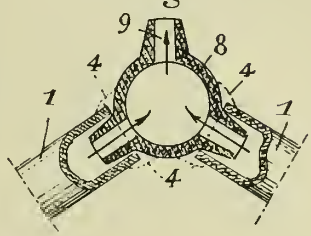


Fig.3.



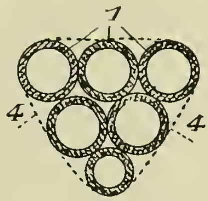


Fig.4.

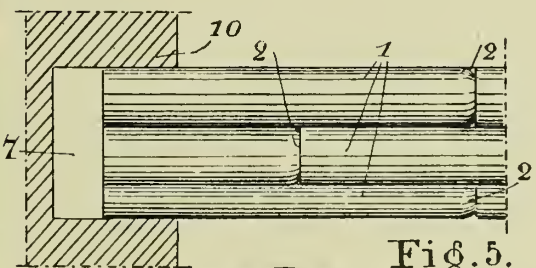


Fig.5.

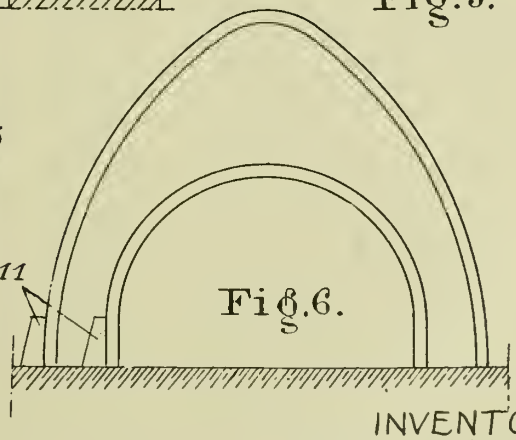


Fig.6.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PREVENTION OF CALCIUM CARBONATE DEPOSITION IN WATER

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No Drawing. Application filed March 13, 1942

The present invention relates generally to the treatment of water and more particularly to the treatment of water to prevent the deposition of calcium carbonate in waters used for industrial purposes.

The carbonate hardness of natural waters consists to the main part of calcium carbonate in solution, which upon heating or upon addition of alkali, such as sodium hydroxide or sodium carbonate, is precipitated, causing in water distribution systems the undesired and disadvantageous scale formation.

Various processes have been resorted to, in order to overcome this evil, which, however, have not proved entirely satisfactory. The treatment by decarbonisation with lime, working according to the chemical equation

$$Ca(HCO_3)_2+CaO=2CaCO_3+H_2O$$

requires a relatively high investment of chemicals and, moreover, necessitates subsequent filtration of the precipitated calcium carbonate. Thus, this process takes too much time and is too expensive for application in cooling waters. The objections to the use of the decarbonisation process apply also to the treatment on basis of base exchange.

Another usual method for the inhibition of carbonate hardness provides the addition of hydrochloric acid, resulting in the formation of water-soluble, non-precipitable calcium chloride. For reasons of precaution in general only as much hydrochloric acid is added, as is necessary to maintain a slight excess of calcium carbonate in the water, since a remaining hardness of 2 to 3° does not or but scarcely tend to scale formation. In spite of this precaution it may be, that hydrochloric acid is—at least temporarily—present in excess, corroding metal tanks and pipe lines. It is a further disadvantage of the above-mentioned method that carbonic acid, liberated by this chemical process, has a highly-corrosive action.

Recently some methods have been developed and have turned out well, according to which deposition of calcium carbonate in waters for industrial purposes is prevented by adding to the water such agents, which delay or completely suppress the precipitation of calcium carbonate, without initiating certain chemical reactions based on certain stoichiometric proportions. Such materials are for example tannic acids, tannin, sulphite lye etc. The use of salts of phosphoric acids having a lower proportion of water molecules than orthophosphoric acid, such as sodium hexametaphosphate, has proved especially favourable.

The last-mentioned processes, however, are disadvantageous in as much as they cannot be used in all occurring applications, since it has been observed that in those cases where the rate of calcium ions in form of calcium bicarbonate exceeds a certain limit, deposition of calcium carbonate can, even by considerable increase of the additions, no longer be prevented.

Now it has been found that the process just described, if suitably combined with the hydrochloric acid process, can also be employed in those cases, in which—owing to the high content of calcium-bicarbonate—it appeared up to now impracticable. Instead of hydrochloric acid other inorganic or organic acids are capable of use, so far as they form with the metal ions of the alkaline earths contained in the water no insoluble or slightly soluble salts, for example the other halogen hydracids, chromic acid, thiosulphuric acid, sulphuric acid and above all their derivatives, such as amido sulphonic acids, sulphonic acids of aliphatic and aromatic compounds of the type of the fatty sulphonic acids, naphthalene sulphonic acid, alkylized naphthalene sulphonic acid, acid sulphuric acid esters of fatty alcohols, and unsaturated or oxy-fatty acids etc. Further be mentioned acetic acid, citric acid, tartaric acid etc.

The present process is generally carried out as follows: At first the necessary amount of acid so as to reduce the content of calcium carbonate to about 8 to 10° is added to the water. In this way it is far easier to avoid an excess of acid in the water than in the case the degree of hardness must be reduced to 2 to 3 by a general treatment with acid. Subsequent thereto, the substance which inhibits precipitation, for example tannin or a phosphoric salt, is added to the water in amounts usual with these methods. It is quite surprising that in the combined process these substances, for example phosphoric salts, develop their full effectiveness, even at a high rate of calcium ions, so far as the calcium ions are present to a considerable part in form of calcium chloride and not in form of calcium carbonate.

The effect obtained by the combination of the two processes may be explained by the assumption that carbonic acid, liberated upon addition of acid, acts reverting on the calcium carbonate, so as to displace the equilibrium in favour of soluble calcium bicarbonate. Moreover, upon addition of chemicals such as tannic acid and phos-

phates, a protective coating forms on the metal surface, which, too, acts against scale formation and reduces at the same time the danger of corrosion caused by acid or CO_2-vapours.

The method according to the present invention applies particularly to that type of waters, the carbonate hardness of which is beyond 15°, or which concentrate by evaporation during the working process is such a high degree that their hardness exceeds the critical limit. To such waters is now added in usual manner as much acid, for example hydrochloric acid, as to reduce the carbonate content to about 6 to 10°. Then the chemical which prevents deposition is added to the water having been treated with acid.

As especially favourable for the present use have proved phosphoric salts, for example the alkali metal salts of hexameta-, poly-, or pyrophosphoric acid as well as the salts of highly polymeric phosphoric acids (Tamman salts) besides tannic acids, tannin, sulphite lye etc. But also the slightly soluble salts of phosphoric acids, such as calcium metaphosphate, crystalline sodium metaphosphate, uranium metaphosphate, zinc metaphosphate, aluminium metaphosphate, double salts, such as sodium-calcium metaphosphate, sodium-magnesium metaphosphate, and calcium-magnesium metaphosphate, can be applied with advantage. Finally the slightly soluble salts of orthophosphoric acid, for example calcium orthophosphate, as well as the naturally occurring phosphate stones, for example apatite, are capable of use.

A preferred embodiment of the present invention provides the application of such an acid which forms with the metal ions of the alkaline earths contained in the water those salts, reacting in the sense of the second phase of the process. Among them be mentioned phosphoric acids, for example orthophosphoric acid, but above all those phosphoric acids having a low proportion of water molecules, such as pyrophosphoric acid, polyphosphoric acid, hexametaphosphoric acid, and still higher polymeric metaphosphoric acids, since their calcium and magnesium salts, employed in amounts considerably below the stoichiometric proportion, have the distinct property of linking the coarse-disperse particles of calcium carbonate to each other, thus inhibiting precipitation with subsequent scale deposition. Organic sulphonic acids, tannic acids etc. belong also to this group. The particular advantage of this special embodiment consists in the remarkable simplification of the present process by substituting one single process for a 2-phase-treatment. To a water, having a carbonate hardness of 18 to 20° for instance, hexametaphosphoric acid is added in an amount so as to reduce the hardness to 12 to 15°. In this case the second phase of treatment becomes superfluous, since the forming calcium and magnesium hexametaphosphate suppresses the precipitation of metal ions of the alkaline earths in form of carbonates.

In the case of a relatively high carbonate content, mixtures of phosphoric or other expensive acids with any acid of inferior quality, for example hydrochloric acid, can be used, in order not to waste the acid of superior quality, but to keep its consumption within narrow limits. Thereby it is only essential to take care that the quote of primary acid is as high as to form calcium salt in a fair amount, viz. about 3 mg. per litre. If the water to be treated has a carbonate hardness of about 30°, it is necessary, for that primary acid becomes efficacious, to add that amount of acid-mixture by which hardness is reduced to at least 15°. The acid of superior quality, however, is not required to constitute the whole amount, by which hardness sinks down from 30 to 15°, but a mixture of for example hydrochloric acid and metaphosphoric acid, in which metaphosphoric acid is contained only to a very small percentage, wholly serves the purpose.

FRIEDRICH SCHÖNAICH.

Published June 8, 1943 Serial No. 434,622

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF CONDENSATION PRODUCTS FROM SULPHITE LYE

Hermann Rudy and Rudolf Watzel, Mannheim, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 13, 1942

The present invention relates to the manufacture of condensation products from sulphite lye and phenols under heating in presence of acids.

A process is known, according to which phenol is condensed together with different kinds of sugar, and the resulting sugar-phenol-resin reacted with sulphite lye. In this process, however, phenol is not condensed with sulphite lye, but the phenol in excess is removed before mixture.

Furthermore, a process for the extraction of lignin from wood has been developed, which provides condensing lignin with boiling phenol in presence of acids, whereat the application of phenol in great excess is necessary. The phenol-lignin thus obtained is slightly soluble in water. According to a recent conception, the ability of condensation of lignin with phenol is said to be restricted by sulphonating the phenol.

Now the surprising discovery has been made that valuable technical products are obtained by condensation of sulphite lye with phenol or phenol-like substances in presence of acid under heating. The condensation products, being well soluble in water, possess lathering power and other capillary-active properties. The sulphite lye can be used either in solution or in form of dried powder. It is expedient to start with cleaned sulphite lye, having a low content of ash.

As an initial material for the present process the simple phenols can be used in first line. Furthermore are suitable the substituted as well as such phenols, containing different hydroxyl groups, for example cresols, xylenols, naphthols, salicylic acid, pyrocatechine, resorcin, hydroquinone, pyrogallol, pyrogallic acid, etc. Finally, the compounds formed by simple linkage of two or more aromatic nucleus, such as dioxy-diphenylsulphone, dioxy-diphenylmethane, etc., can be employed with advantage. So far as the melting points of the mentioned compounds are above the desired temperature of reaction, it is advisable to apply them in mixture with other compounds, melting at lower temperatures, preferably with phenol or homologous substances.

To carry out the condensation, concentrated and diluted hydrochloric acid, sulphuric acid, orthophosphoric acid, as well as metaphosphoric acid, and especially those phosphoric acids having a low proportion of water molecules, the P_2O_5-content of which is between that of ortho- and metaphosphoric acid, are suitable.

According to the present invention, condensation is carried out at temperatures between 50 and 150° C., preferably between 70 and 120° C. At the beginning careful working is recommended, in order to avoid the formation of high-molecular, insoluble products.

The proportion of the amounts applied of phenol and sulphite lye can be varied within a wide range. As a rule, however, equimolecular proportions will be chosen, starting thereby from the weight of 180 for one gram molecule of lignin. If working with rapid-condensing compounds, it is advantageous to keep the rate of phenol below 1 gram molecule or to dilute it by addition of such phenol substances, reacting less energetically. The amount of acid is chosen so that the pH-value of the initial mixture is below 4.

Example 1.—300 g. of pulverized, dry sulphite lye with an ash content of 4 to 6% are thoroughly mixed with 75 g. of molten phenol and 200 g. of anhydrous phosphoric acid of a P_2O_5-content of 82 to 86%, the phosphoric acid having before been heated to 150° C. The mass is left to itself for some time. The temperature of the mass gradually softening is 70 to 90° C. As soon as cooling begins, the compound is still heated for a short while on the boiling water bath, until a homogeneous, relatively fluid substance is obtained, which solidifies after cooling to a black resin, well soluble in water.

Example 2.—300 g. of pulverized sulphite lye with an ash content of 4 to 6% are mixed with 75 g. of phenol and 12 g. of anhydrous phosphoric acid, having a P_2O_5-content of 86%. The mixture is then heated in the oil bath up to 110 to 120° C. for 2 or 3 hours. After cooling, a black, brittle resin, easily soluble in water of pH 2.8 to 3.0, is obtained.

Example 3.—Working as per Example 2 with the modification that instead of phenol 115 g. of α-naphthol are used and the mass is heated to 130° C. for 1 hour.

Example 4.—To 300 g. of pulverized, dry sulphite lye are added: at first a molten mixture of 50 g. of resorcin and 30 g. of phenol, and in addition 200 g. of phosphoric acid of a P_2O_5-content of 85%, the phosphoric acid having before been heated to 150° C. After having left the mass to itself for some time, it is heated in the oil bath to 130° C. for 1 hour. In this way a well lathering, water-soluble product is obtained.

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[illegible]

Published June 8, 1943 Serial No. 439,937

ALIEN PROPERTY CUSTODIAN

ANTI-FREEZING COMPOSITION

William Levenson, Paris (Seine), France; vested in the Alien Property Custodian

No Drawing. Application filed April 21, 1942

As is known, commonly used anti-freezing compositions are constituted by solutions of calcium chloride, magnesium chloride or zinc chloride. Such known compositions have the disadvantages of attacking white metals and of quickly corroding ferrous metals.

An object of the present invention is to provide as a new composition of matter an improved anti-freezing composition devoid of the aforesaid disadvantages and ensuring adequate protection against freezing even in the case of very bitter frosts such as are commoly encountered in most inhabited countries of the world.

Another object of the invention is to provide a method of producing the foregoing improved composition with particularly good anti-freezing characteristics by simple means.

The anti-freezing composition according to the invention may comprise by way of example a solution of sodium nitrite or potassium nitrite or a mixture of these two nitrites in water or an equivalent aqueous or other solvent.

An anti-freezing composition thus constituted neither attacks nor bites alloys comprising aluminum, zinc or copper and protects ferrous metals against corrosion or the formation of rust while efficaciously withstanding very high frosts without becoming congealed. It can be verified that the freezing point of an aqueous solution of sodium nitrite is as low as —27° C. while the freezing point of an aqueous solution of potassium nitrite is —31° C.

These freezing points are low enough to render anti-freezing compositions according to the invention suitable for most practical uses as for example in automobile radiators or in water containers liable to remain exposed to frost action during any prolonged period of time.

A suitable method of preparing a particularly efficient anti-freezing composition made up of a mixture of potassium and sodium nitrites consists in dissolving sodium nitrite in water at an approximate temperature of 15° C. until saturation is reached, then using this solution as a solvent for such a quantity of potassium nitrite as to again reach saturation. A composition thus obtained will not set into solid form under frost action unless it is subjected to a temperature equal to or lower than —40° C.

By lessening the proportions of sodium and potassium nitrites, compositions can be obtained which while not being so resistant to very heavy frost are still usefully utilisable for a wide range of practical applications.

WILLIAM LEVENSON.

Published June 8, 1943

Serial No. 440,417

ALIEN PROPERTY CUSTODIAN

ULTRA HIGH FREQUENCY WAVE COUPLING DEVICES

René Hardy and Pierre de Maertelaere, Lyon, France; vested in the Alien Property Custodian

Application filed April 24, 1942

The present invention relates to inductive coupling devices for high frequency electromagnetic waves, and particularly but not exclusively to ultra short wave direction finders.

In long and medium wave radio direction finding systems, use is frequently made of stationary aerials positioned in perpendicular planes and connected to the stators of a radio direction finder. The windings of the stator are perpendicular and they reproduce the field of the stationary aerials. A rotor that rotates within these windings may be considered as rotating in a field having the same orientation as that of the space occupied by the aerials. This requires that the radio direction finder should have the turns of its coil windings suitably distributed, so that the current induced in the rotor may always be proportional to the sine of the angle that is formed by the mean plane of the rotor with a reference plane.

In radio direction finders constructed for operating with ultra short waves, one is limited to considering finders that have only one winding turn for each stator and likewise only one winding turn for each rotor. It thus becomes impossible to employ a suitable distribution of the winding turns for correcting errors of variation in the current induced in the rotor at its various angular positions with respect to the abovementioned reference plane.

One of the objects of the present invention is consequently that of providing radio direction finders which do not have errors of this kind in the variation of the current induced in the rotor. According to certain of its features, it attains this purpose by providing the use of a rotor that does not consist of a plane symmetrical winding turn, but of an element of such a geometrical configuration that the sinusoidal law is adhered to as a result of this configuration.

In one variant of the invention, the rotor of an ultra short wave radio direction finder or other inductive coupling device consists of two out-of-true surfaces having a symmetry with respect to a point, a straight line or a plane surface, and of such a shape that the voltages tapped at this rotor's terminals vary according to the desired sinusoidal law.

More specifically, in one example of embodiment that makes use of features of the invention, an ultra short wave induction finder or distributor comprises two orthogonal plane winding turns which serve as stators, and a rotor which consists of two diametral hemispherical zones assembled with their segments staggered by 90° (i. e. with a reciprocal angular displacement of 90°).

The invention will be explained in the following description given with reference to the appended drawings, in which:

Fig. 1 illustrates schematically one example of the arrangement of an ultra short wave radio direction finder.

Fig. 2 illustrates schematically an ultra short wave inductive finder or distributor which is specially suitable for the radio direction finding arrangement of Fig. 1.

Fig. 3 is a diagram that shows the manner in which the rotor of the finder of Fig. 2 brings about an octantal error of the induced current, the curve of this octantal error being illustrated in Fig. 4.

Fig. 5 in perspective, and Fig. 6 in plan view, illustrate a stator of an ultra short wave finder, together with diagrams of the respective fields.

Fig. 7 shows variation curves of the current induced in the rotor of an ultra short wave finder, and

Figs. 8 to 10 illustrate one example of an embodiment of a rotor of an ultra short wave finder that makes use of features of the invention.

As shown in Fig. 1, an ultra short wave radio direction finder's receiver may comprise two aerial assemblies 1 and 2 disposed at 90° from each other and connected to the orthogonal stators 3 and 4 of a finder 5. The rotor 6 is connected by any suitable connecting means, e. g. by collector rings 7, to the input circuit of the receiver 8. A graduated dial 9 which moves over a stationary index 10 permits manual actuation of the finder's rotor 6. This drive may also be effected continuously by means of a motor 11.

The rotor of the finder 5 is tuned by means of a variable condenser 12, and the rotor 6—condenser 12 assembly serves as input circuit for the receiver 12, thus making it possible to avoid losses in the transmission of energy from the aerials 1 and 2 to the receiver 8.

In view of the wave lengths under consideration, the stators 3, 4 consist of single winding turns 13 and 14 (Fig. 2) positioned in perpendicular planes and respectively connected to the stationary aerials. The rotor likewise consists of a single winding turn 15 which is connected to the receiver by the collector 7 and may be manually driven by a control knob 16. The coupling between the feed of the stators and the output circuit of the rotor is obviated or lessened by means of a sheathing tube 17 which surrounds the connections of the rotor 15.

Inspection in Fig. 3 of one of the stationary winding turns of the stator, e. g. winding turn 13 which has an orientation of 0° to 180°, and of the movable winding turn 15 of the rotor that rotates within the stators 13 and 14, shows that there is no error in the amplitude of the wave transmitted from the stators to the rotor when the rotor's winding turn is in the plane of the stator's winding turn 13. However, when the rotor is in a certain position 15 or 15′ and it indicates a zero value of the field induced by the stators, this value is wrong because the rotor is nearer to one of the stators than the other. If the resultant field has a minimum that lies at 45° or 145°, the indication given by the rotor's current will be correct because in this position the rotor is equidistant from the two stators; there is no asymmetry, and consequently no error. The cycle of error is repeated at each quadrant and this results in an octantal error curve of which an example is given in Fig. 4.

For the purpose of making more understandable the manner in which this octantal error occurs and the solution provided by the present invention, reference is made to Fig. 5 which gives a perspective view in two perpendicular planes of the two winding turns 13 and 14 which form the stators of the finder. These two turns are connected to the aerials 1, 1′ and 2, 2′ which consist, for example, of two orthogonal dipoles located in an unencumbered place where the propagation is uniform.

The direction of the field with respect to one of the aerials, e. g. is indicated at 20, the angle of this direction with respect to the aerial being θ.

If I_{max} is the current in the aerials 1, 1′, and consequently in the winding turn 13, when the wave comes into the plane of the aerials, the current in the turn 13 becomes for the represented direction of the field:

$$I_{13}=I_{max}\cos\theta \qquad (1)$$

Similarly, in winding turn 14 the induced current will be:

$$I_{14}=I_{max}\cos(90°-\theta)$$
$$=I_{max}\sin\theta \qquad (2)$$

Since the two winding turns 13 and 14 that form the stator are in orthogonal planes, $\vec{0.1}$ and $\vec{0.2}$ may be taken to represent the fluxes of the turns 13 and 14, these vectors being perpendicular.

The resultant flux is proportional to $\vec{0.20}$ and forms an ϕ angle with $\vec{0.1}$. It is possible to set down:

$$\text{tg}\phi=\frac{I_{max}\sin\theta}{I_{max}\cos\theta}=\text{tg}\,\theta \qquad (3)$$

i. e. $\theta-\phi$; the angle of incidence of the wave with respect to the aerials 1, 1′ is equal to the angle of the resultant flux with respect to the winding turn 13.

Since the angle $\widehat{102}$ is a right angle,

$$\vec{0.20}^2=\vec{0.1}^2+\vec{0.2}^2,$$

which is equivalent to stating that the resultant flux is proportional to

$$\sqrt{I^2_{max}(\cos^2\theta+\sin^2\theta)}$$
$$=I_{max} \qquad (4)$$

By examining the field produced in this way within the two winding turns of the stators, and a section of the stators as shown in Fig. 6, 13′—13′′ being the section of the winding turn 14′—14′′ the section of the other staggered by 90°, it is seen that $\vec{0.20}$ is the direction of the field resulting from the vectorial addition of the fields created by the currents I_{13} and I_{14}.

Assuming that the wave field, repeated by the stators, is constant in the entire space that will be occupied by the rotor within the said stators, the flux that passes through the winding turn of the rotor 15 at all times is

$$\phi=H_{max}S\sin\alpha\sin\omega t \qquad (5)$$

and the induced electromotive force is:

$$e=-\frac{2\chi C}{\lambda}H_{max}S\sin\alpha\cos\omega t$$
$$=-e_{max}\cos\omega t \qquad (6)$$

in which

$$e_{max}=\frac{2\chi S}{\lambda}C\,H_{max}$$

the field being $H_{max}\sin\omega t$, the surface of the rotor's winding turn being indicated by S, the angle of the line normal to the plane of the rotor's winding with the direction $\vec{0.20}$ being α and the flux that passes through it at the moment t being indicated by ϕ; C indicates the rate of propagation in air of an electromagnetic wave.

The orientation of the rotor accordingly makes it possible to ascertain the point of zero reception, i. e. the minimum and maximum of reception, which should be at 90° from each other.

A certain number of conditions have to be complied with in order to obtain a precise indication. First of all, the phase relation between the currents of the antennas is of great importance and, for this purpose, the transmission line leading from the aerials to the rotor's two winding turns, and also the rotor and the aerials themselves, have to be constructed in strictly symmetrical fashion.

It is not possible to tune the stator's two winding turns to operate at resonance and thus get the benefit of a considerable excess voltage. As a matter of fact, the current in the winding of a stator varies in dependence upon a slight variation of the pulsation of the current or of the frequency of the transmission, and all the more according as the excess voltage coefficient is greater. With very high excess voltage ultra short wave circuits there would occur, when close to resonance, a considerable variation of the current in the rotor's winding for very slight mechanical variations in the apparatus. As a rule, these mechanical variations correspond to variations of capacity.

Since the angle of the direction of the field reproduced by the two rectangular windings depends on the ratio of the intensities of the currents in the stators, the orientation of the field becomes wrong as soon as the slightest maladjustment occurs in the circuit, a variation of a few micromicrofarads corresponds to a considerable rotation of the field. It is therefore necessary to make use of an aperiodic circuit finder system, only the rotor being tuned or forming part of a tuned circuit, e. g. the input circuit of the receiver as shown in Fig. 1.

The field within the windings of the stators must be uniform. Even if the field reproduced by the two winding turns may be considered as a reproduction of the field of space, it is not necessarily uniform. This lack of uniformity becomes all

the more apparent the more one departs from the shape of a long solenoid in constructing the stators, and this is the case in short wave finders that have stators consisting of only two winding turns, as this brings about a distortion of the field.

A rotor that consists of a single winding turn rotating within the two winding turns of the stators will not indicate the precise directions for various reasons, first of all on account of the shape of the field, and also on account of the capacities resulting from variations in the coupling of the rotor to the stators, these being all the greater because it is necessary to select diameters as close as possible for the winding turns of the stators and the rotor in order to insure efficient coupling.

The rotor's indications can accordingly only be correct when the rotor is in the plane of one of the stators and in the bisector planes. For the other positions, there will be a coupling error or octantal error, e. g. like the one shown in the curve of Fig. 4.

In order to correct these distortions of the field or, to be more exact, the octantal errors they occasion in the current induced in the rotor, it becomes necessary to deform the winding turns, either of the rotor or of the stator.

The simplest solution is to give consideration to a deformation of the single winding turn of the rotor. In order to undertake this modification, account is taken of the expression given above for the electromotive force induced in the rotor's winding:

$$e = -\frac{2xC}{\lambda} H_{\max} S \sin \alpha \cos \omega t$$

It can be seen in Fig. 6 that this electromotive force is represented by the vector $\overrightarrow{0.21}$ whose end describes a circle **22** tangential at **0** to the normal **24** to the direction of propagation **20**; for a complete rotation of the rotor, this corresponds to the complete diagram **22—23** of the classic **8** shape of radio direction finders.

This variation of voltage may also be traced lineally. The curves **25**, **26** and **27** of Fig. 7 show examples of this for finders that have an octantal error or defects in the distribution of the field. In order to restore the true sinusoidal curve **28** (Fig. 7), it is necessary to maintain the sinusoidal relation. If E is the voltage induced in the rotor **15** and α the angle of this rotor with respect to a stator, e. g. **13**, E will always have to be proportional to sin α.

The present invention consequently provides for the construction of rotors for short wave radio direction finders which have stators that each consist of a single winding turn, by making use of an out-of-true winding turn that is suitably deformed in order to maintain the above mentioned sinusoidal relation. Furthermore, in order to insure efficient coupling between the stator and the rotor, another feature of the invention provides particularly for the use of a rotor that consists of an out-of-true surface that is symmetrical with respect to a plane surface, a straight line or a point, that has dimensions substantially equal to those of the stators, and that maintains the said sinusoidal relation.

Figs. 8 to 10 illustrate one example of an embodiment of a stator for ultra short wave finders that makes use of features of the invention. The rotor shown in these figures consists of two hemispherical shells **30** and **31** in each of which the two opposite half-domes have been cut away perpendicularly to the plane of their base, as shown at **32** and **33** in Fig. 8.

These two half-shells are assembled by a metallic connection (Fig. 9) with their segments staggered by 90° as shown, connection wires **35** and **36** being soldered at the point diametrically opposite to the connection **34**.

A rotor of this kind, which is strongly coupled by mutual induction to two perpendicular stators **37** and **38** (Fig. 10) that each consist of one plane winding turn, is traversed during its rotation by an induced current having a substantially sinusoidal shape like that shown at **28** in Fig. 7, taking into account the distance between the stators and the rotor.

It is evident that the dimensions of the staggered segments will depend on the desired coupling between the rotor and the stators.

It is also evident that the invention is by no means limited to the shape of the rotor shown as an example, and that numerous other designs may be provided for the rotor without departing from the scope of the invention.

The uses to which the invention may be applied are not limited as above mentioned to radio direction findings; for example, the invention may also be used in the construction of progressive or any other kind of attenuators for determination of the output or input current of a generating or oscillating instrument, or even of an amplifier.

Summary

The present invention relates to inductive coupling devices for high frequency electromagnetic waves and it particularly aims at providing radio direction finders, progressive attenuators, etc. which do not shown octantal errors according as the rotor rotates within the stator. The rotor accordingly does not consist of a plane symmetrical winding turn, but of a winding turn that is deformed by buckling or by an out-of-true surface having such a geometrical configuration that the variation of the current induced in the rotor will remain sinusoidal during its rotation.

In particular, an inductive coupling device that makes use of features of the invention may comprise two orthogonal plane winding turns that serve as stator and a rotor which consists of two diametral hemispherical zones assembled with their segments staggered by 90° from each other.

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JUNE 8, 1943.

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ULTRA HIGH FREQUENCY WAVE

COUPLING DEVICES

Filed April 24, 1942

Serial No.

440,417

2 Sheets-Sheet 1

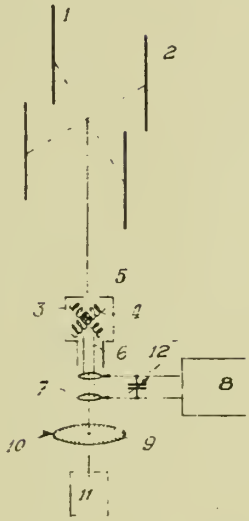

FIG. 1

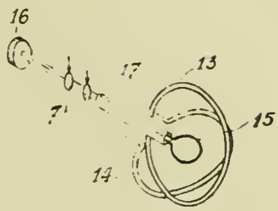

FIG. 2

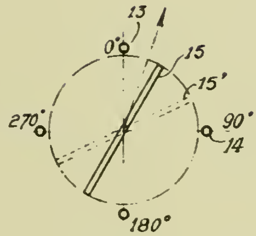

FIG. 3

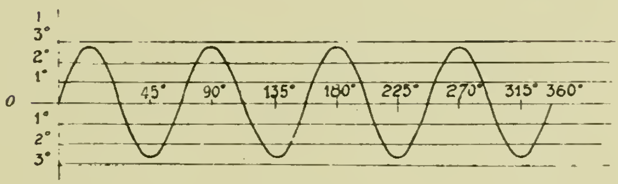

FIG. 4

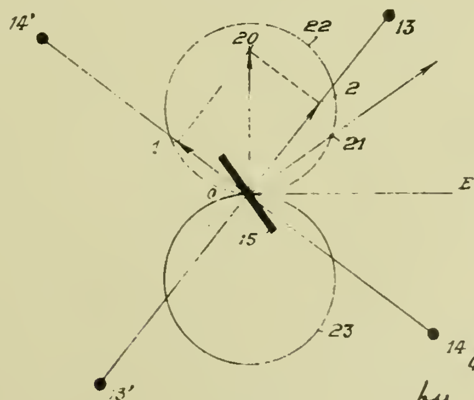

FIG. 6

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2 Sheets-Sheet 2

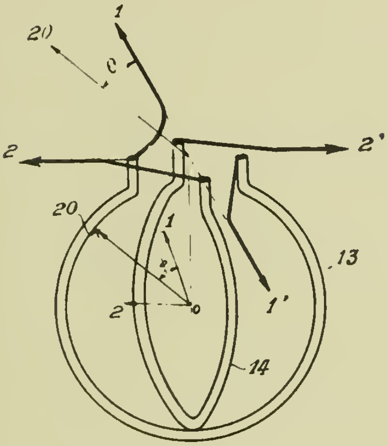

FIG.5

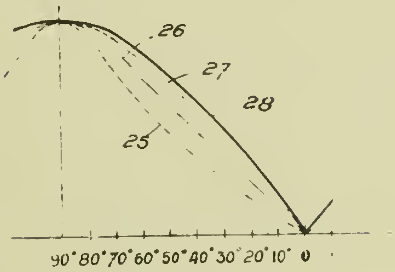

FIG.7

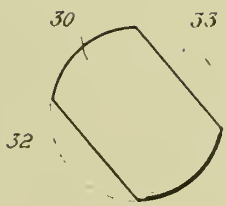

FIG.8

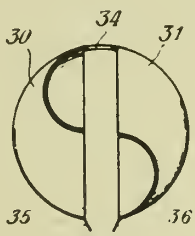

FIG.9

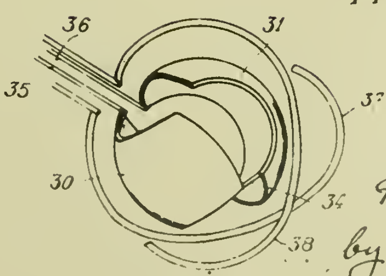

FIG.10

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ALIEN PROPERTY CUSTODIAN

DRIVING JOINT FOR CONTROL DEVICES FOR RETRACTABLE MEMBERS ON BOARD AIRCRAFT

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Application filed May 21, 1942

In my prior Patent No. 2,148,972, I have described driving joints for control devices for retractable members on board aircraft, which joints consist of two parts pivoted together, one of which forms a case containing an electric motor and a speed reducing gearing transmission, which drives the other part to produce a relative rotation of the two parts.

This invention aims at improving in different respects this kind of joint, more particularly in view of making the operation thereof easier and more progressive, also safer, of improving its efficiency, of avoiding the wedging of the toothed wheels due to the distorsion of the case and of obtaining a more compact construction by a new arrangement of the members when one of the parts is located at the middle of the length of the other.

The various improvements provided in this type of joint in accordance with this invention may be applied together or individually without departing from the spirit of this invention.

One of these improvements consists in that, the speed reducing transmission comprising at least one epicyclic gearing one of the sun wheels of which turns freely when the motor is not running but is automatically brought to rest when the motor is running, the device provided for thus stopping said sun wheel consists of a progressively acting coupling including plates pressed together by centrifugable weights.

The shocks occurring with the positive couplings such as claw clutches and free wheel devices are thus avoided.

In a convenient embodiment, said stopping coupling is inserted at a point of the transmission where the reduction ratio of the transmission section between the coupling and the second part of the joint, i. e. that differing from the part thereof which forms a case, is sufficiently reduced to prevent said transmission section being substantially irreversible as soon as said coupling is disengaged, while yet being such that the torque to be transmitted by the coupling may have a moderate value, whilst the coupling centrifugable weights are carried by a member rotated at a more faster speed than that of the coupling, being for instance directly driven from the motor or even speeded up. It may thus be used small weights, light and of reduced bulk, whilst allowing the joint to be rotated by the action of the load or another external force when the motor is not running and the coupling is disengaged.

Preferably, in accordance with a development of the first improvement, the weights press the plates through the medium of springs and an abutment limits the centrifugal stroke of said weights. Thus the thrust on the coupling cannot exceed a predetermined limit, whatever the speed of the motor may be. The weights may consequently be so designed as to exert a suitable thrust on the coupling when the motor runs at a speed corresponding to its normal load and, whatever may be the increase of speed due to the motor running with no load or with a reduced load, said pressure on the coupling remains the same, as does also the maximum resisting torque above which slipping of the coupling occurs. Otherwise, the coupling would either slip too easily at low speeds or not sufficiently at high speeds.

Another improvement consists in that the transmission comprises two sections one of which, having a small speed of rotation and a large transmitted torque, includes at least one epicyclic gearing and the other of which, having a greater speed of rotation and a smaller transmitted torque, consists of simple toothed wheels arranged in a circle round the shaft coming from the motor, said wheels forming either a single train driving the epicyclic gearing or several parallel trains each driving the epicyclic gearing and each driven by a common intermediate pinion connected with the driving pinion through a single intermediate train.

To the advantages of better efficiency obtained through the use of simple toothed wheels at high speeds of rotation are thus added the advantages of great reducing ratios and greater compactness of the epicyclic trains whose efficiency at low speeds is satisfactory.

A further improvement consists in that, the motor being located at one end of the case, and the second part of the joint being located at the middle of said case, the driving shaft extends through the case up to the opposite end and the gear transmission is concentrated between that end of the shaft which is removed from the motor and said middle of the joint.

A further improvement consists in that the transmission assembly is supported by sleeves or drums which, due to their being mounted with an annular gap in the case, to which they are secured solely by means of flanges, are free from flexure distorsions of said case.

In order to illustrate how the above improvements may be carried out, the annexed drawings show as an example,—to which the invention is however by no means limited,—a driven joint in

which all these improvements are embodied, said joint comprising besides various other features constituting detail features of the invention.

In these drawings:

Fig. 1 is an axial sectional elevation of the driving joint, the upper half of the figure showing the position of the members when the motor is running and the lower half showing the position thereof when the motor does not run.

Fig. 2 is a schematic view showing the circular set of wheels.

Fig. 3 is a schematic view showing this set of wheels unrolled, i. e. with their various axis brought in the same plane by unrolling of said set.

Fig. 4 is a view at a larger scale of a detail.

In this embodiment, the joint is of the known type comprising an outer case 1 containing at one end an electric motor 2 supplied with current by means of cables 3. To the ends of this case are fastened bars 4 to which other bars 5 are pivoted coaxially with the case 1. Upon a bearing provided on the outside of case 1 is mounted the second part 7 of the joint, which second part is constituted, in this case, by a ring connected with the two bars 5 by a rod, not shown, parallel with the axis of the joint.

In accordance with this invention, a shaft 9, having a great length and a small diameter so as to be able to yield elastically, more particularly in torsion, and connected to the motor shaft by a coupling 10, which may either be of the cardan, the elastic or the floating type, extends axially through the whole of the case 1 and is connected, at its opposite end, also by means of a cardan, a resilient or a floating coupling, to a sleeve 11 supported in two roll bearings 12 and 13, respectively secured to the end bottom 14 of the case 1 and to a cross partition 15 secured to a large sleeve or drum 16. The case 1 is subdivised transversally in three sections assembled end to end by means of flanges 17, and the drum 16 itself is secured to said case by means of a flange 18 located between adjacent flanges 17 of adjacent sections. The diameter of this drum is slightly smaller than the inner diameter of the section in which it is located, so that its cylindrical part is not contacting with the case, an annular gap being provided therebetween. To the base end of the drum 16 is secured another partition 19 carrying centrally a hub 20 coaxial with the joint. The two partitions 15 and 19 support in ball bearings a set of shafts 21, 22, 23, 24 and 25 arranged in a circle around the axis of the joint and carrying spur wheels, viz: the shaft 21 carries two wheels 26, 27 of different diameters, the biggest of which, 26, gears with a pinion wheel 28, keyed to the main shaft 9, and the smallest of which, 27, gears with the largest, 29, of two wheels 29 and 30 keyed to the shaft 22; to the shaft 23 are secured two other toothed wheels 31, 32, the largest of which, 31, engages with the smaller wheel, 30, whilst the smallest, 32, drives a larger wheel, 33, keyed to the shaft 24 to which is also secured a smaller wheel 34 loosely mounted on the hub 20, said wheel 35 gearing with two wheels 36, 37 oppositely arranged, the first of which, 36, is keyed to the shaft 25 and the second, 37, rotates freely on the shaft 22. These two wheels 36, 37 are connected with sleeves extending through the partition 19 and carrying on the other side thereof pinion wheels 38 gearing with a common wheel 40 carried by a ball bearing 41 secured to the hub 20. Said wheel 40 is fast with another wheel 42 which forms the center sun wheel of an epicyclic gearing train comprising several planet pinions 43 carried by a cage 44 and in mesh with the inner set of teeth of an external sun wheel 45. On the outer periphery of said sun wheel 45 are threaded coupling plates 46 adapted to cooperate with other plates 47 threaded in a drum 48 which is secured to the case 1 in the same way and by similar means as the drum 16. The planets-carrier 44 is fast with gear teeth 49 arranged concentrically therewith and forming the sun wheel of another epicyclic gearing comprising planet pinions 50 and a stationary orbit formed by gear teeth 51 of the drum 48. The planet pinions 50 are carried by a cage 52 having a hub provided with gear teeth 53 driving two diametrically opposed pinions 54 carried by shafts 55 secured in partitions 56 of the middle section of the case 1 in register with the second part 7 of the joint, said second part being provided with inner gear teeth 57 in gear with pinions 54. It will be noted that the planet pinions of each epicyclic gearing and the corresponding center sun wheel are solely centered by their gear teeth and those of the external orbit which allows a slight tilting of the shafts of the successive gearings.

In order to press the annular coupling plates 46 and 47 together, there is provided a ring-shaped pusher 58 on a skirt portion of which is slidably provided a plate 59 which may be shifted against springs 60, interposed between said pusher and said plate, through the medium of rods 61 extended through the partitions 15 and 19 and guided thereby, said rods being moreover in contact with a plate 62 carried by a joint ball 63 supported, with interposition of balls, by a ring 64 slidable on the sleeve 11 driven by the shaft 9. This ring 64 is engaged by rocking levers 66 responsive to centrifugal weights 67 carried by a cage 68 fast with the sleeve 11 and the edge 69 of which provides a stop limiting the centrifugal stroke of the weights. Springs 70, here shown as surrounding the end of the rods 61, exert on the plate 62 an axial thrust against that which it supports from the weights 67 when the motor runs and whereby it is urged to move to press together the coupling plates 46, 47. A stop 71 (Fig. 4) on the skirt of the plate 58 limits the sliding stroke of the plate 59 so that the springs 60 are always kept energised to some degree. Small springs 72 attached to the plate 58 and to the partition 19 hold the plate 58 out of engagement with the coupling plates when the motor is not running.

The operation is as follows:

At rest, when the motor 2 is not running, the elements of the coupling device are in the position shown in the lower half of Fig. 1. When the motor is started, the torsionally elastic shaft 9 is at once rotated and, through the pinion 28, drives the whole gear train 26 to 42; as the coupling plates are not pressed together, the sun wheel 45 is free and rotates loose, driven by the planets which turn loose on their shafts while the planets-carrier 44 remains motionless. At the same time, the shaft 9 causes the sleeve 11 and the weight-carrying cage 68 to rotate; the weights 67 are moved outwards by the centrifugal force acting thereon and cause the spherical thrust ball-bearing 63 to slide, which latter push in the rods 61 against the action of the springs 70 and said rods 61 push the plate 58 through the medium of the plate 59 and the already energised springs 60, thereby bringing the plate 58 into contact with

the coupling plates against the action of the springs 72 and progressively pressing together the plates 46 and 47. The sun wheel 45 is thus progressively braked and brought to rest according as the pressure on the plates increases in response to the progressive outwards motion of the weights as the speed of the motor 2 increases, which compels the planets-carrier 44 to progressively get into rotation and this rotary motion is thus transmitted by the second epicyclic train 49, 50, 51 and the wheels 53, 54 to the second part, 7, of the joint, which part then turns on the case 1. For a given speed of the motor, the thrust of the rods 61 on the plate 59 exceeds the initial energisation of the springs 60, and said plate 59 is slightly shifted on the skirt of plate 58 thereby, more compressing said springs 60. Soon after, the weights impinge against the edge 69 of the cage 68 and, henceforth, the pressure on the plates 46 and 47 remains constant and determined by the rate of compression of the springs 60, whatever may be the increase of speed of the motor. If the resistant torque is abnormally high and exceeds the friction torque of said plates under said constant thrust, slipping occurs between said plates relatively to each other and the risk of the gear wheels being broken is thus avoided. When the motor stops, the weights are moved back inwardly and the springs 60, 70 and 72 bring the parts back to their rest position. The prevision of the abutment 71 enables to limit the total stroke necessary to uncoupling to an amount much lower than that needed for the complete de-energisation of the springs 60, and nevertheless to prevent said springs, which remain energised at rest, from exerting then a thrust on the plates 46, 47, this being obtained as soon as the plate 59 attains said abutment 71. The wheel 45 is thus entirely released, which permits the joint to work freely under the action of an external force tending to cause a relative rotation between the two parts of the joint, such as, for example, the weight of a landing gear during the lowering thereof.

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PUBLISHED	C. R. WASEIGE	Serial No.
JUNE 8, 1943	DRIVING JOINT FOR CONTROL DEVICES FOR RETRACTABLE MEMBERS ON BOARD AIRCRAFT	443,964
BY A. P. C.	Filed May 21 1942	2 Sheets-Sheet 1

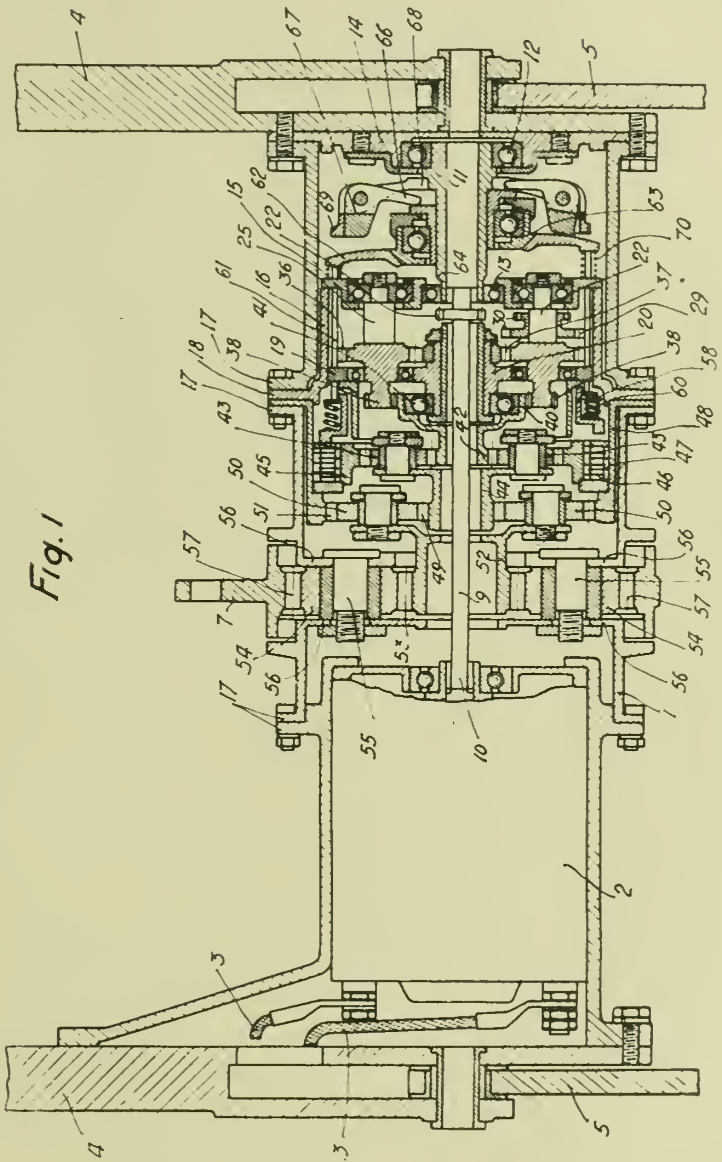

Fig. 1

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Serial No.
443,964

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Fig. 2

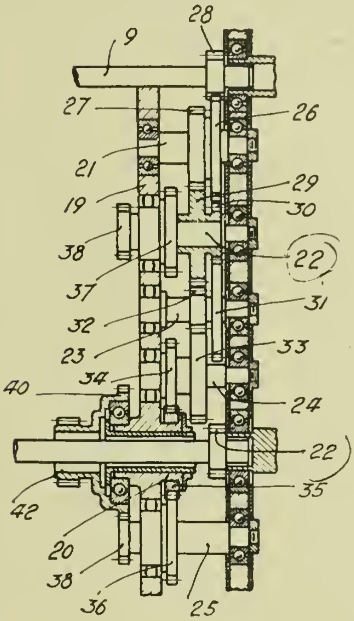


Fig. 3

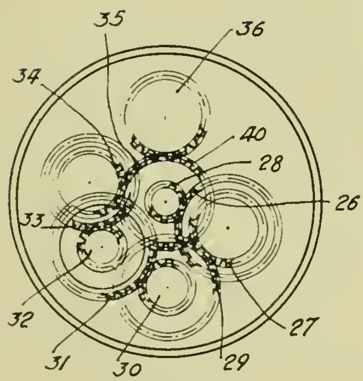
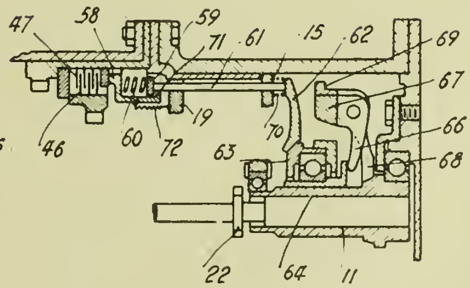


Fig. 4



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ALIEN PROPERTY CUSTODIAN

REMOVABLE DRIVING EQUIPMENTS FOR CYCLES AND CYCLES PROVIDED THEREWITH

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Application filed May 21, 1942

This invention relates to a removable driving equipment capable of being applied to bicycles and other cycles so as to convert the same into light motor cycles. By the expression "driving equipment" is usually meant an assemly comprising an engine and a few accessories such as carburetter, ignition device, gear case and the like.

One object of the invention is to provide an equipment adapted to be instantly mounted on a bicycle of the usual type and also quickly removed therefrom, in such a manner that the cyclist may, at will, either make use of it or leave it for using its bicycle in the usual manner.

Another object is to provide an equipment of reduced weight and bulk which will not strain the frame.

A further object is to provide an engined cycle of reduced weight and having a good efficiency both when driven by the engine or through the pedals.

Still other objects of the invention will appear from the following description of a preferred embodiment thereof.

In the annexed drawings:

Fig. 1 is a general side view of an embodiment of an equipment according to the invention.

Fig. 2 is a corresponding plan view, the petrol tank being omitted and the cylinder being shown in section.

Fig. 3 is a fragmentary side view of the rear wheel of the bicycle, showing the driving rim and the pinion straddling over said rim, said pinion being shown in section.

Fig. 4 is a longitudinal sectional view of said pinion and rim.

Fig. 5 is a sectional detail of the rim in a plane at right angle to one of the spokes of the wheel, so as to show the securing means.

Fig. 6 is an end view of the flange nut on which the equipment is to be secured.

Fig. 7 is a part sectional side view of said flange nut.

Fig. 8 is a side view of the external nut adapted to be screwed on said flange nut.

Figs. 9 and 10 are respectively side and end views of the reaction clip secured to the horizontal fork.

Fig. 11 shows a modified embodiment.

The assembly shown in Fig. 1 comprises an engine proper 1, of the two-cycle type in the illustrated instance, the crank case of which is fast with another case 2 containing three gears 3, 4 and 5, the first of which is mounted on the shaft of the engine 1, the second of which is mounted on a shaft 6 which protrudes rearwards of Fig. 1, as will be apparent from the plan view of Fig. 2, and the third of which is mounted on the shaft of an ignition device 7 (Fig. 2), secured to a base fast with the case 2. The assembly comprises further a petrol tank 8 with its plug 59, the whole being carried by a supporting arm 9 secured to the case 2 by means of suitable bolts, not shown. The tank 8 carries a carburetter 10, which communicates with the engine 1 through an intake tube 11. Lastly, the engine 1 carries an exhaust pot 12 fast with the whole of the described assembly.

The whole assembly is secured by means of two bolts 13 (Fig. 2) to a square angle-like fastening lug 14 to be attached to the spindle of the rear wheel. In view of this attachment, instead of the usual nut securing the spindle to the frame, there is provided a special nut 15 (Figs. 6 and 7) which is in the shape of a sleeve provided with an external screw thread and with an end flange or collar 16. This nut 15, which may remain permanently on the bicycle, since the normal use of the latter is not hindered thereby, receives the lug 14, which is clamped against the flange 16 by means of a supplementary nut 17 (Fig. 8).

As will be apparent from Fig. 2, the lug 14 is provided with elongated slots 18 through which the bolts 13 are adapted to pass, so as to permit of adjusting the assembly with respect to the middle plane of the bicycle.

The part of the shaft 6 which protrudes from the case 2 is provided with splines and is adapted to receive a pinion, which has been omitted in Fig. 2 but details of which are shown in Figs. 3 and 4. Said pinion consists of two cheeks 19, fast with a common splined hub 20, said cheeks carrying fixed pins 21 supporting rollers 22 which are loose thereon, the whole forming thus a lantern pinion with rotatable pins. The pinion 19—20—21—22 gears with an inner set of teeth provided on a rim 23 attached to the rear wheel, the cheeks 19 straddling over the said set of teeth (Fig. 4) for maintaining axially the pinion on its shaft 6.

The rim 23 is attached to the rear wheel through the medium of the spokes thereof, each spoke 24 (Fig. 5) being clamped underneath a small clamp 25, made of pressed sheet metal and tightened by a screw 26, the spoke being moreover maintained between the stem of the screw 26 and a turned down flange of the clamp 25.

Between the gear 4 (Fig. 8) and its shaft 6 (Fig. 2) is preferably provided a claw-clutch of any suitable type, such as a sliding dog collar clutch the slide collar of which may be operated from the outside by means of a small handle, such

as 27 (Figs. 1 and 2). This device permits of the bicycle being rolled freely when it is provided with the driving equipment and the latter is not in running condition.

The lug 14 is extended forwardly by an arm 28 terminating in a fork 29. The latter is adapted to engage with a flange stud 30 (Figs. 1, 9 and 10) which is one of the bolts used for permanently fastening a clip 31 to the horizontal fork 32 of the cycle. The engine assembly is thus retained in position and is prevented from turning round the rear spindle even in case the nut 17 would have not been sufficiently tightened.

It will be apparent that the engine can be removed when desired by simply taking off the nut 27, without it being necessary to tamper neither with the pipings nor with the transmission, since the pinion 19—20—21—22 will then be disengaged from the shaft 6 and thereafter removed from the rim 23 on which it remains resting.

The assembly needs only two transmissions for its control, i. e. one for the control of the mixture (cable 51) and another for controlling the release of pressure. The latter is effected by a small valve closed by a pincers spring 60 (Fig. 1), one limb of which receives the pressure of the sheath 61, whereas the other supports the pull of the cable 62. In order that the removing may still be easily effected, these controls are adapted to be easily removed, for example by unhooking, as is usual with brakes. The flexible transmission members may also be adapted to permit of being removed, being then secured by means of spring clips. If desired, the control handles may themselves be secured in the same removable manner to the handle bar, though they may well be left in position as they are no hindrance when the machine is used as a bicycle without engine.

It will thus be apparent that the invention permits to convert instantly a bicycle into a light motor cycle by screwing a single nut, viz the nut 17, the driven cycle differing from an ordinary cycle only by the provision of the rim 23 (which may be made very light in weight by using light alloys) and of the small and hardly visible clip 31.

Referring to Fig. 11, the arm 28 forming an extension of the engine support is connected with the limb 32 of the horizontal fork of the bicycle rear wheel by means of a semi-elastic coupling. For this purpose, this arm 28 terminates in a perforated lug sliding along a curved rod 70 which is secured to the clip 31 and maintained in position by two counteracting springs 72 and 73 coiled around said rod on either side of the arm 28.

These springs serve as a suspension damper and damp the vibrations which are thus prevented from being transmitted to the frame.

Further, as shown in the same figure, the petrol tank 8 is located at a higher level than the engine block and is removably hooked, by means of bolts, to the rear luggage carrying bracket of the machine.

Obviously, the foregoing description is not to be construed as limiting in any manner the ambit of the invention, as the described details thereof may be replaced by any equivalent means without departing from the spirit of the invention. While all the arrangements shown and described co-operate to carry out an improved driving assembly affording the above-mentioned advantages, some of these arrangements might be omitted or replaced by others affording the same general results.

PIERRE VEROTS.
GEORGES MARQUET.

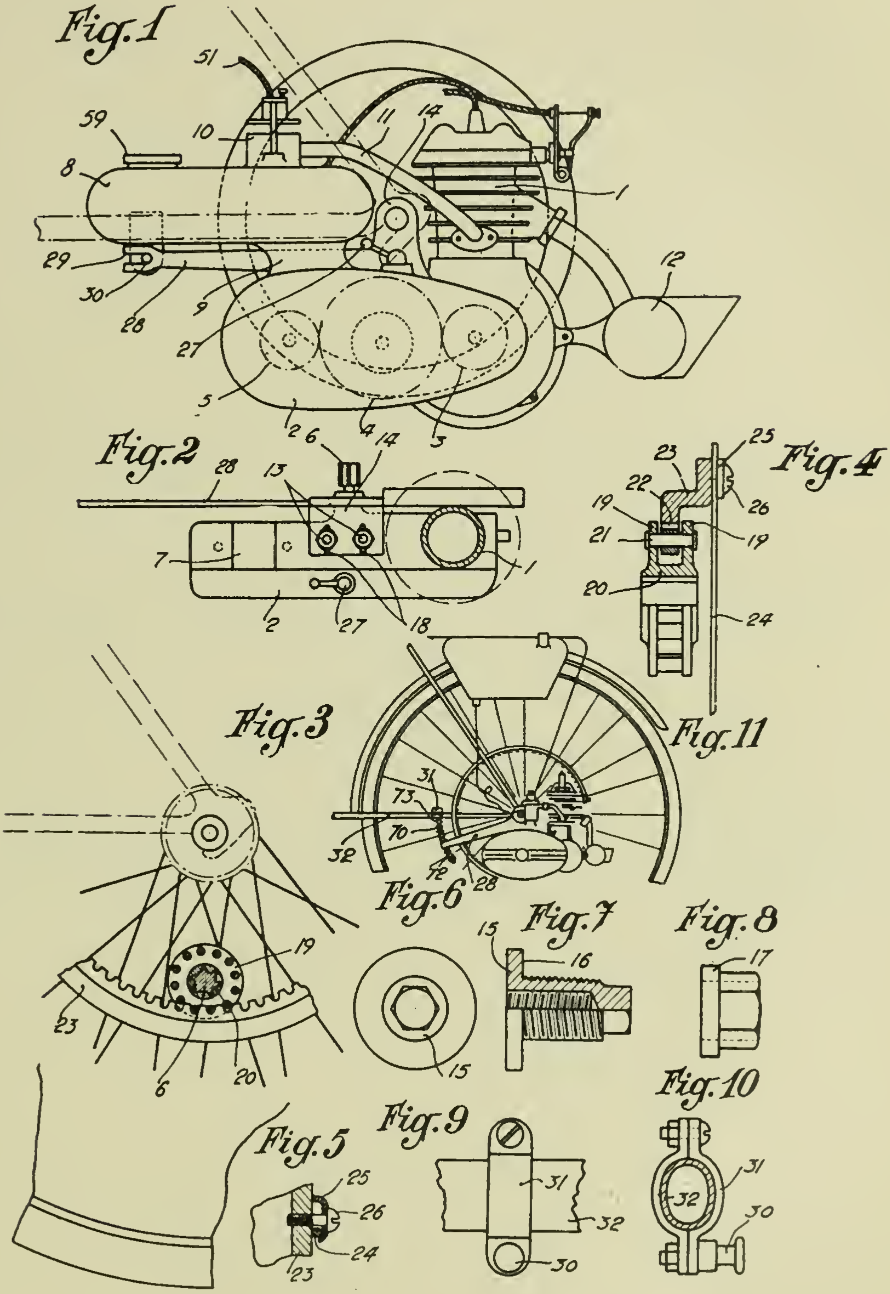
PUBLISHED

JUNE 8, 1943.

BY A. P. C.

P. VEROTS ET AL
REMOVABLE DRIVING EQUIPMENTS FOR CYCLES
AND CYCLES PROVIDED THEREWITH
Filed May 21, 1942

Serial No.
443,970



Inventors
Pierre Verots & Georges Marquet
By Glascock Downing & Seebold
Attys

Published June 8, 1943

Serial No. 434,079½

ALIEN PROPERTY CUSTODIAN

ADHESIVE UNITS

Otto Lesser, Berlin, Germany; vested in the
Alien Property Custodian

Application filed March 10, 1942

Adhesive units are known; but it is a disadvantage that they cannot be made adhesive on both sides without separating them by a detachable non-adhesive cover strip.

By the new adhesive unit the adhesive parts are so arranged that they do not touch each other, thereby they can rolled up or disposed in layers without a cover strip. In Figs. 1 and 2 is designed the strip with *a* the adhesive part with *b*.

OTTO LESSER.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

O. LESSER
ADHESIVE UNITS
Filed March 10, 1942

Serial No.
434,079½

Fig. 1.

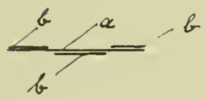
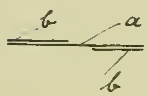


Fig. 2.



Adhesive units, Otto Lesser, Berlin, Germany, 10. Mai 1941.
to 3

Published June 8, 1943 Serial No. 440,830

ALIEN PROPERTY CUSTODIAN

METHOD OF RECOVERING RUBBER AND RESULTING PRODUCT

Jacques Maurice Theodore Hauvette, Clermont-Ferrand, France; vested in the Alien Property Custodian

No Drawing. Application filed April 28, 1942

The present invention relates to a new rubber composition and method of manufacturing the same, and embodies, more specifically, a new method of recovering rubber from articles which contain rubber but which, for certain reasons, are no longer serviceable for the uses for which they were originally produced.

The recovery of rubber from used articles such, for example, as old automobile tires and the like, is now accomplished generally in either one of two ways. On the one hand, the recovery is accomplished mechanically by crushing or tearing the old article into small particles in apparatus such as hammer mills and the like. The cotton fibers are separated from the rubber particles pneumatically and the resulting product is in the form of a fine powder or shoddy and shredded pieces. If the recovery is effected chemically, the fine particles produced as above mentioned are treated with a compound that will dissolve or destroy the cotton fibers.

The rubber obtained by either of the above existing processes is agglomerated under the action of heat, with perhaps the use of a solvent to produce a pasty mass which is then used in a homogeneous mixture with fresh rubber. This mixture is provided with the necessary ingredients to accomplish the vulcanization in any known fashion.

It appears that the violent working and heating of the rubber, or perhaps the action of oxygen on the finely divided particles under the heated conditions produced by grinding, alter the rubber chemically and/or physically and thus destroy its resiliency and wear-resisting qualities. Similarly, the action of the solvent on the vulcanized rubber may be such as to alter the rubber chemically and/or physically.

The product resulting from the processes heretofore used, as above described, therefore, is of inferior quality. Its elasticity is considerably below that of originally produced rubber and the resistance of such product to wear and cuts is materially impaired.

Inasmuch as the reclaimed vulcanized rubber cannot be converted to an unvulcanized state by any known treatment, it retains its impaired physical characteristics even when mixed with unvulcanized rubber. The reclaimed rubber thus imparts its altered and undesirable qualities to the mixture of reclaimed and new unvulcanized rubber. Subsequent vulcanization of the new rubber does nothing to improve the characteristics of the reclaimed rubber and, in fact, may further reduce its resiliency and wear-resistance. The impairment of the desirable qualities in the final produce is generally proportional to the content of recovered rubber of such product and, as a result, rubber containing recovered rubber has heretofore been used only where first class or a prime quality of rubber is not essential.

An object of the present invention, therefore, is to provide an improved method for recovering such rubber and making it available for further use without impairment to the qualities thereof.

A further object of the invention is to provide a new product or composition of matter in which recovered rubber is utilized without impairing the properties of the composition or product.

In accordance with the present invention, rubber is recovered from used products in such fashion that it retains all of the desirable qualities which it secured upon its original vulcanization, and the resulting product formed of such recovered rubber and fresh rubber is found to have all of the desirable properties of originally vulcanized rubber.

More particularly, the recovery of the rubber is accomplished by cutting the rubber from the used articles, the cutting being accomplished in such fashion that the rubber is formed into small pieces or grains. In such operation, care is exercised not to crush or tear the rubber inasmuch as it appears that such operations cause the degradation previously referred to.

An alternative method of removing the rubber from the products from which it is to be recovered is by chilling the rubber sufficiently to make it hard and brittle and then subjecting it to a crushing operation to form small polyhedric grains of rubber.

The stresses utilized by these methods of subdividing the rubber into polyhedric particles without degradation are referred to hereinafter as "shearing" in order to distinguish from the hammering, tearing and grinding operations upon flexible rubber which occur in hammer mills and the like, heretofore used in mechanically reclaiming rubber, and which subject the particles to the hereinabove mentioned stresses that result in the degradation thereof.

The particles or grains obtained in either of the two ways above mentioned are then incorporated directly into a fresh rubber mixture which is vulcanized in any desired fashion to produce the desired result. In producing the final product, it is preferable that the particles of recovered rubber that are used in the mixture have the properties that are to be obtained in the final product.

This will insure a homogeneous product of greatest serviceability.

It is preferable in introducing the recovered rubber into the mixture of fresh rubber that the recovered rubber be introduced at the end of the mixing or milling operation and in such fashion that the grains of recovered rubber are not subjected to crushing and such other forces as may tend to impair the quality of the rubber. As above stated, the method of vulcanizing the mixture of fresh rubber and recovered rubber may be any of the methods now commonly in use, and, if the grains of recovered rubber are formed in the manner hereinabove described, they will be found to possess all of the desirable properties of the rubber in its originally vulcanized condition. The fresh rubber and recovered rubber may be mixed in various proportions or, if desired, the fresh mixture may be used merely as an agglomerating agent for the recovered grains. The final product, accordingly, consists of a mixture containing grains of rubber that have been recovered in the manner above described and possess the characteristic features of the vulcanized rubber in the product from which the grains were recovered. These grains of rubber having unimpaired qualities are formed, with the fresh rubber, into a homogeneous mass by the vulcanization of the fresh rubber in the mixture and, by properly selecting recovered grains having desired characteristics, these characteristics are formed in the freshly vulcanized rubber in order to provide a product having the desired homogeneity.

The size of the particles of rubber may be varied considerably, but it is preferable to shear the rubber into relatively small pieces, the practical lower limit being determined by the cost of shearing the rubber. On the other hand, the upper limit of the particles is restricted for the reason that excessively large particles cannot be molded uniformly with the fresh rubber and will not penetrate properly into the design, for example, of a tire mold. Therefore, for practical purposes the longest dimensions of the rubber particles should be between about 0.02 and 0.4 of an inch.

While the recovery of rubber has been described, for purposes of illustration, as being effected from used automobile tires, it will be apparent that the invention is applicable to the recovery of rubber from any source and to its mixture and subsequent treatment in such fashion as to produce a final product having desired properties.

JACQUES MAURICE
THEODORE HAUVETTE.

Published June 8, 1943

Serial No. 449,539

ALIEN PROPERTY CUSTODIAN

ELECTRIC COMPENSATOR FOR PLANTS FOR LOCATING SOUNDS

Raymond Joseph Jasse, Vichy, France; vested in the Alien Property Custodian

Application filed July 1, 1942

The present invention has for object an electric compensator for plants for locating sounds in space by means of a set of receivers or microphones distributed all round the compensator and in the circuits of which are inserted electric elements or cells of variable retardation, composed of a self shunted by a capacity, said elements being so chosen that to any direction of sound can correspond a combination of said elements intended to ensure the placing in phase of all the electric currents issuing from the receivers. The compensator is actuated in order to obtain a maximum amplitude of the sound corresponding to the placing in phase of the microphone currents and the combination of retarding elements thus obtained then gives the indication of the direction of the sound.

Apparatus of this type are known in which the compensator comprises a collector formed by a flat plate capable of rotating about a central spindle at right angles to its plane—which is at the same time the central point of compensation for all the receivers—and on one face of which are secured rectilinear electric contact blades, of the same width, parallel to each other, contiguous, but electrically insulated from each other.

Each of the contact blades of the collector is connected to one of the retarding cells mounted in parallel between two wires to form together an artificial line of uniform retardation, the two wires of which are connected to the input of an amplifier, at the output of which is connected the listening-in apparatus, for instance a loud-speaker.

The wiper brushes are distributed on the flat surface of the collector so as to form a geometrical figure which must be a true reduction of the real geometrical figure formed in plan, by the receivers distributed all round the compensator.

It is known that in this arrangement, the set of receivers is compensated when the axis of symmetry of the collector,—which is at right angles to the direction of the blades—forms with the axis of the geometrical figure formed by the brushes, an angle equal to that made by the direction in which the sound is propagated with the axis of the geometrical figure formed by the set of receivers.

Compensators having a flat collector have the serious inconvenience that it is mechanically very difficult to simultaneously or separately displace the wiper brushes to adapt the compensator to the variations of the speed of the sound according to the medium of its propagation, on the one hand, and to the shape of the geometrical figure formed by the receivers, on the other hand.

As regards this latter point, it is known that, for instance on a ship, the installation of the microphones can be but rarely rigorously in conformity with a pre-established plan; for obtaining perfect similitude between the geometrical figure formed by the receivers and that formed by the wiper brushes of the compensator, one is therefore led to fix the position of said brushes according to the assemblage of the receivers. Moreover, a compensator already in service can only be replaced by another compensator at the expense of costly and laborious transformations.

In order to adapt the compensator to the different speeds of sound, the geometrical figure formed by the wiper brushes must be homothetically enlarged or reduced relatively to the plan of the geometrical figure formed by all the receivers, and this can only be done by radially displacing the brushes relatively to the centre of rotation of the collector which is at the same time the centre of compensation for all the receivers. Now, for effecting the rapid adaptation of the compensator to the medium of the propagation of the sound, it is necessary that the radial displacement of all the brushes should take place simultaneously by means of a single operating knob, which leads to an extremely complicated, costly and very delicate mechanical device.

The object of the present invention is to remedy this inconvenience; the problem consists in distributing the blades of the collector on the periphery of a cylinder in such a manner that the adaptation of the compensator to the medium of propagation of the sound can be obtained by a simultaneous axial displacement of the brushes, and said axial displacement can be obtained by means of an extremely simple and cheap mechanical device; the measurement of the azimuth of the sound is then effected by a circular movement of the brushes in a plane at right angles to the axis of the cylinder.

Starting from a flat collector having rectilinear contact blades of the same width, parallel to each other, contiguous, but electrically insulated from each other, the cylindrical collector according to the invention can be obtained by dividing the flat collector into a certain number of annular elements by equidistant circles concentric with the centre of rotation of said flat collector and by enlarging said annular elements with the fractions of blades they carry, proportionally up to the diameter of the outer circle, or by reducing said annular elements and their fractions of blades down to the diameter of the inner circle, the cylindrical shape of the collector then resulting from an equidistant superposition of the enlarged or reduced elementary circles.

The accompanying drawing shows a form of construction of a collector according to the invention.

Fig. 1 illustrates a flat collector divided into elementary circles.

Fig. 2 illustrates the origin of a cylindrical collector according to the invention by the super-

position of enlarged or reduced annular elements.

Fig. 3 is a side elevation of a collector constructed according to the data of the invention.

Fig. 4 is a view similar to that of Fig. 3, but offset to the extent of 90° relatively to the latter.

Fig. 5 is a cross section made according to line V—V of Fig. 3.

Fig. 6 shows in vertical section a diagrammatic view of a unit constituted by a compensator provided with the new collector.

Figs. 7 and 8 show in front view and side view a modification of the support for the brushes.

Figs. 9 and 10 show a preferred embodiment of the object of the invention.

As shown in Fig. 1, the flat collector which serves as base for the construction of the cylindrical collector according to the invention, comprises a certain number of rectilinear contact blades l, of the same width, parallel to each other, contiguous, but insulated from each other. Each of the blades is electrically connected to a retarding cell, composed of a self S and of a capacity C and all the cells are inserted in parallel in an artificial line of uniform retardation, constituted by two wires b and c respectively connected to the input terminals d_1, d_2 of an amplifier A, the output terminals e_1 and e_2 of which are connected to the terminals of a loud-speaker HP.

On the contact blades l rub a number of contact brushes f diagrammatically illustrated in the figure. The arrangement of all the brushes forms a geometrical figure indicated in dotted lines and which must be the true reduction of the plan of the geometrical figure formed by all the microphone receivers not shown. Each receiver is connected by a conducting wire to one of said contact brushes f.

The plate carrying the contact blades l is rotatively mounted about a centre O′ which must exactly coincide with the centre O of the compensation for all the microphone receivers. X—X designates the axis of symmetry of the collector, at right angles to the direction of the contact blades l. Y—Y is the axis of the figure formed by all the wiper brushes f and which must be set exactly as the axis of the plan of the figure formed by all the microphone receivers. It will be seen that the set of receivers will be compensated when the angle formed by X—X and Y—Y is equal to the angle formed by X—X with the axis of the figure formed by all the receivers.

For converting the flat collector according to Fig. 1, on which the wiper brushes f must be radially displaced to adapt the compensator to the speed of propagation of the sound, into a cylindrical collector on which the same adaptation is effected by an axial displacement of the wiper brushes, said flat collector is divided into annular zones by equidistant circles g_1, g_2, g_3, g_4 . . . etc. up to the circle of maximum compensation G. Each of the circles g_1, g_2, g_3, g_4 . . . etc. is then enlarged up to the diameter of the circle G, that is to say that the points of intersection of said circles with the edges of the contact blades l are radially transferred on to the circle G, which is assumed to correspond to the diameter of the cylindrical collector it is desired to obtain (Fig. 2).

Taking for instance the inner circle g_1, the points of intersection h_1, h_2, h_3, h_4, h_5 and h_6 are radially transferred on to the circle G, on which are then obtained the points i_1, i_2, i_3, i_4, i_5 and i_6, the enlarged distribution of which is exactly the same.

The same method of procedure is adopted for all the circles g_2, g_3, g_4, up to the circle of maximum compensation G, and the points thus found on the circle G for each of the circles g_2, g_3, g_4 are respectively projected on equidistant superposed planes l_1, l_2, l_3, l_4, parallel to the axis of symmetry X—X of the flat collector.

The lateral elevation of the cylindrical collector shown in Fig. 2 results therefrom, whereas the points found on the circle of maximum compensation G correspond to the exact position of each of said points on the periphery of the cylindrical collector.

Fig. 3 shows in side elevation the unit constituted by a cylindrical collector thus obtained, seen in the direction of the arrow F_1 of Fig. 1, whereas Fig. 4 is a similar elevation, but seen in the direction of the arrow F_2 of Fig. 1.

Fig. 5 shows in cross section the setting of the axis of symmetry X—X of the collector.

The mathematical translation of the two conditions to be satisfied by the collector according to the invention:

Measurement of the azimuth of the sound by a circular movement of the wiper brushes in a plane at right angles to the axis of the cylindrical collector,

Modification by axial displacement, of the ratio of similitude between the figure formed in plan by all the microphone receivers and that of the wiper brushes in view of adapting the compensator to a variation of the speed of the sound,

will also be advantageously effected by taking as a basis the consideration that the cylindrical collector according to the invention is obtained by a particular transformation of a flat collector having rectilinear and parallel blades.

In this case, a basis can be taken on the fact that, for satisfying the first condition, it is necessary that, in a plane at right angles to the axis of the cylindrical collector, the distribution of the contact blades should be such that the interval e_c between the axes of two adjacent blades projected on the axis X—X is constant (Fig. 5).

The end blades l_x of the cross section c—c (Fig. 3) define on the artificial line of retardation two positions separated by a number of cells SC equal to

$$\frac{D}{e_c}$$

and consequently to a retardation

$$\frac{D}{e_c}\cdot r$$

r designating the retardation per cell. The cross section c—c (Fig. 3) is therefore suitable for the brush of a microphone located at R_c from the centre of compensation, if:

$$\frac{2R_c}{a}=\frac{D}{e_c}\cdot r$$

in other words, if

$$e_c=\frac{aDr}{2R_c}$$

Likewise, the cross section d—d is suitable for the brush of a microphone located at a distance R_d from the centre, if

$$e_d=\frac{aDr}{2R_d}$$

and as a, D and r are constants, it will be seen that, generally speaking, R is reversely proportional to e.

If now the speed of the sound varies and becomes equal to a', the brushes must be moved according ti a generatrix of the collector to bring them on new cross sections c'—c' and d'—d' in which the intervals

$$e'_c=\frac{a'Dr}{2R_c}=e_c\cdot\frac{a'}{a}$$

and

$$e'_d=\frac{a'Dr}{2R_d}=e_d\cdot\frac{a'}{a}$$

Now, the law which determines the value of the interval e on a cross section in function of its distance y from the apex of the collector is exponential, that is to say that:

$$E=kv^y$$

k and v being constants.

It results therefrom that if the intervals e are considered on the four cross sections c—c, d—d, c'—c', d'—d', the following equations are obtained:

(1) $e_c=kv^yc$
(2) $e_d=kv^yd$
(3) $e'_c=kv^{y'}c$
(4) $e'_d=kv^{y'}d$

By dividing side for side the equation (3) by the equation (1), and equation (4) by equation (2), one obtains:

$$\frac{e'_c}{e_c}=v(y'_c-y_c)$$

and

$$\frac{e'_d}{e_d}=v(y'_d-y_d)$$

Now, it is necessary that

$$\frac{e'_c}{e_c}=\frac{a'}{a}=\frac{e'_d}{e_d}$$

therefore that

$$v^{(y'c-yc)}=v^{(y'd-yd)}=\frac{a'}{a}$$

consequently:

$$y'c-yc=y'd-yd=\log_v\frac{a'}{a}$$

This proves that it suffices to move all the brushes along their generatrix to the same extent

$$\log_v\frac{a'}{a}$$

This operation is very easy to effect mechanically, it suffices that all the brushes should be mounted on a common support which can slide along the axis of the collector.

This arrangement has been obtained in the embodiment of the compensator according to the invention diagrammatically illustrated in Fig. 6.

However, in this arrangement, the block of wiper brushes **9** receives the setting movement as a bearing whereas the collector **4** receives the longitudinal movement of translation allowing to adapt it to the speed of sound. Between two plates **1** is mounted a shaft **2** which is fixed and on which is mounted by means of the bracing **3** the collector **4** according to the invention. The block **3** can slide along the shaft **2** in the guide **5**, owing to the nut **6** and the screw **7** controlled by a fly-wheel **8**. The brushes are mounted, for instance in the manner described, on the block **9** the rotation of which is controlled by the operating fly-wheel **10**. A ring collector **11** allows of supplying current to the brushes.

Without departing from the principle of the invention, devices might also be imagined in which the block of brushes or the collector receives the two movements of translation and of setting, the other member being then completely stationary.

Figs. 7 and 8 show a particular assemblage of the wiper brushes. Said brushes **35** of square cross section, are made of carbon of high copper content. They slide in a tubular metallic guide **36** covered with an insulating tube **37** and closed at one end by a beaded cover **38**.

The brush **35** is connected by a flexible wire to a terminal **39** and it is pressed against the surface of the collector **45** by a coil spring **40**. The guiding tube **36** and its insulating sheath **37** are clamped in a slotted metallic block **41**.

Said block is slidable in a groove **33** formed in a supporting upright **33a** and in which it can be secured in a given position by a foundation plate **43** and two screws **44**. The sliding movement of block **41** causes the brush **35** to slide axially on the collector **33a**. Its position in the groove **33** depends on the horizontal distance between the corresponding microphone receiver and the centre of compensation O of all the receivers. The runner indicating the position is formed by the upper edge of the block **41**. The graduation carried by the supporting upright **33a** indicates the distance.

Figs. 9 and 10 show a preferred embodiment of the compensator forming the subject-matter of the invention.

Two rectangular plates **56** and **57** (see Fig. 9) braced by four columns **58** form a rigid cage in the form of a parallelepipedon.

Between the plates **56** and **57** freely rotates a central shaft **59** which carries all the rotating members of the compensator. The shaft rests on an abutment, not shown, located in the recess of the lower plate **57**.

On shaft **59** are mounted, starting from the top, the following members (see Fig. 10) which rotate therewith:

(a) The output line collector having three rings **60** which is keyed on the shaft and held in position by the screw **61**.

(b) A circular plate **62** secured on the square shoulder of the shaft.

(c) A cylindrical sleeve **63** keyed on the shaft and which supports the following members:

1°—A circular plate **64** similar to plate **62** and secured by the screws **65**.

2°—A toothed ring **66**. Said ring serves for driving the shaft and also as a support for the relay terminals **12** between the blades of the collector and the artificial line.

3°—A compensating collector **13** which is keyed on the sleeve **63** and held in position by a ring screw threaded at the lower part.

The two circular plates **62** and **64** are braced by four right-angle members **15**. It is between these two plates that the boxes **16** are mounted containing the elements of the artificial line. Fig. 10 clearly shows the securing of said boxes on the right-angle members **15** by means of yokes **17** and screws **18**, the boxes carry a stud which engages in the holes provided for that purpose on the square part of the shaft. The boxes are distributed in four piles.

Each box is constituted by two symmetrical half-boxes assembled by three screws. The four terminals are grouped on a small plate fitted between the two half-boxes.

On the upper circular plate **62** is secured a cylindrical compass-card **19** in four equal sectors centered by a tongue engaging in a groove of the plate and secured by screws **20**. The sec-

tors are connected together at their lower part by small screwed reinforcing plates **21**.

The compass-card carries two graduations: one, continuous, from 0 to 360°, and the other in two parts from 0 to 180° in reverse direction.

The bearing of the receivers is read on one or the other of said graduations opposite the pointers of the frame **22** screwed on the upper plate **56** of the cage.

From the rings of the output line collector **60** lead flexible wires which pass through the plate **56** in grooves formed in the shaft.

The members connected to the hull are:

The brush-carrying sleeve **23** and its accessories (see Figs. 9 and 10). The sleeve **23** is centered on the shaft **59**; it supports a graduated circular ring **24** having a groove, and held on the arms of the sleeve by the screws **25**. The fixed setting of the sleeve relatively to the cage is ensured by the finger **26** rigid with the lower plate **57**. The rectilinear sliding movement of the sleeve is obtained by the screw having square threads **27** driven by the grooved plate **28** and the train of pinions **29** and **30**.

The pinion **29** carries a graduated drum **31** which allows of locating the vertical position of the ring **24** which is read opposite the index **32** rigid with the lower plate **57**. The graduation is expressed in speed of sound.

The ring **24** is concentric with the compensating collector, it carries grooved uprights **33** which are secured by their base by means of screws **34**.

A line engraved on the base allows of locating the position of the upright along the graduation in degrees of the ring **24**. Finally, the section of the passage-way of the screw **34** allows of locking the upright at any angle.

The angle of lead of an upright is moreover equal to the angle formed by the corresponding radius of the microphone (that is to say the line which joins the projected centre of the diaphragm of said microphone, and the centre of compensation **0** of the group) with the front-rear axis of the structure; said angle is counted from the front and in the usual direction of the bearings.

RAYMOND JOSEPH JASSE.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

R. J. JASSE
ELECTRIC COMPENSATOR FOR PLANTS FOR LOCATING SOUNDS
Filed July 1, 1942

Serial No. 449,539

4 Sheets-Sheet 1

Fig.2

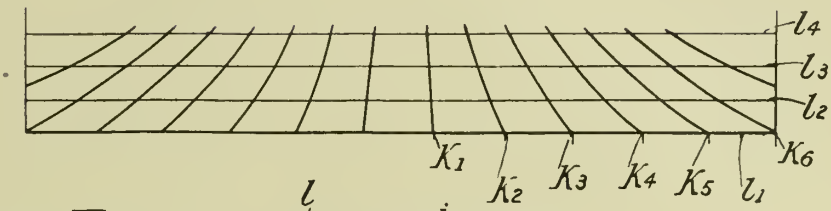
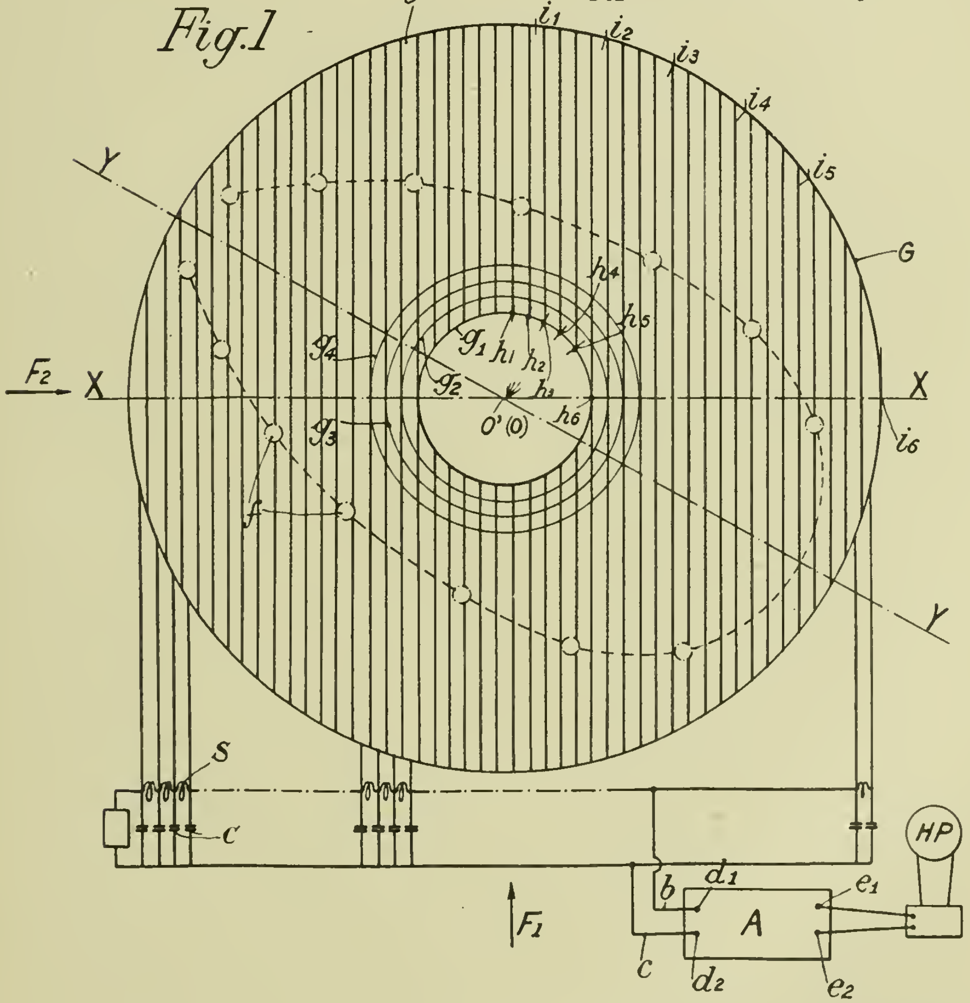


Fig.1



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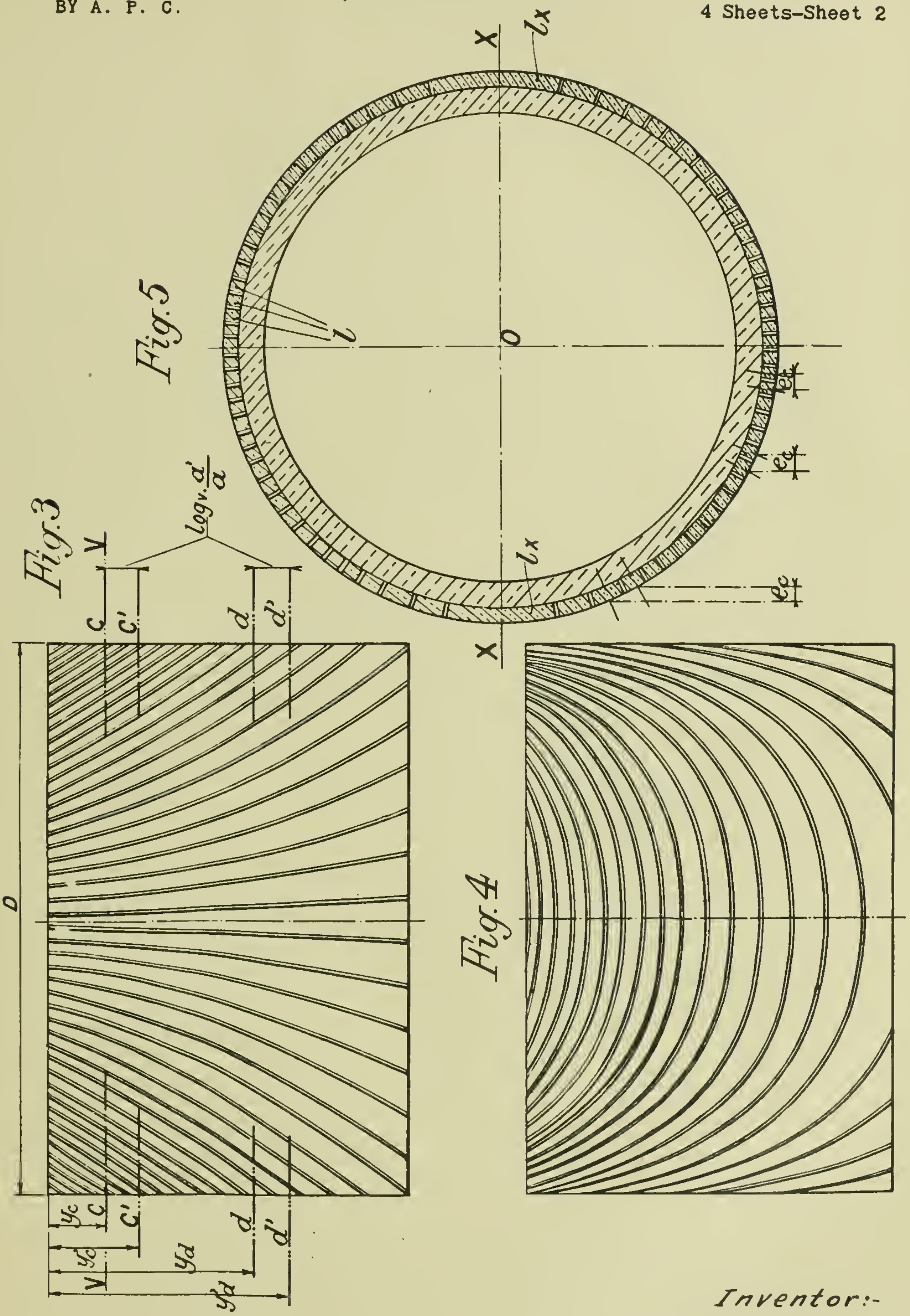
4 Sheets-Sheet 2



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4 Sheets-Sheet 3

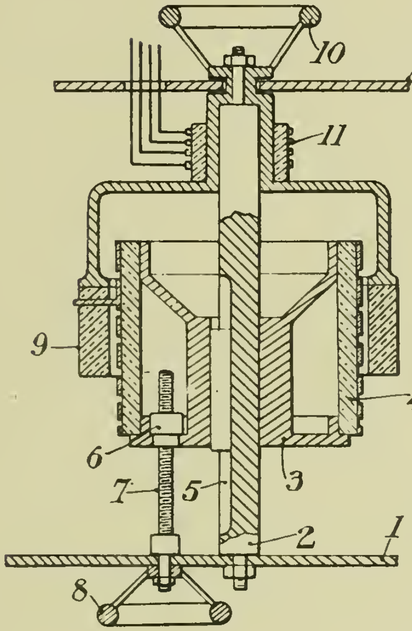


Fig.6

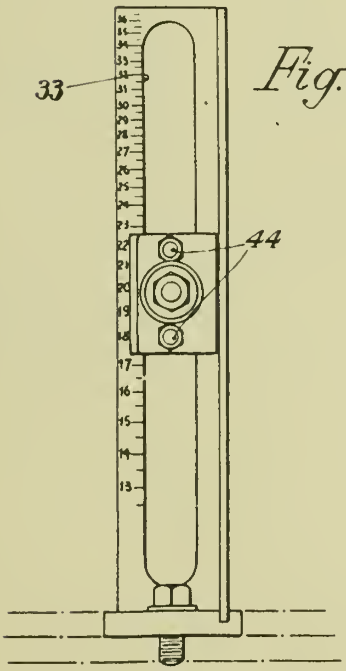


Fig.7

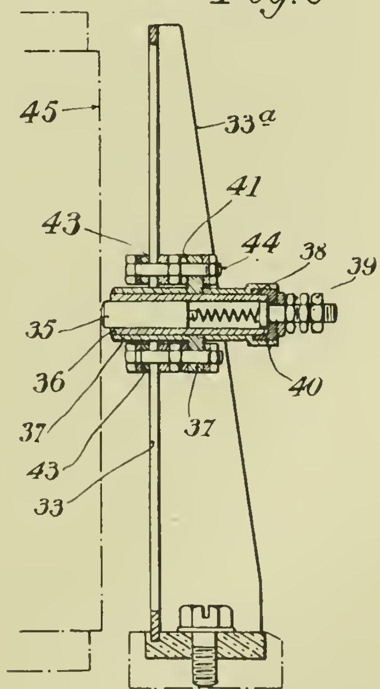


Fig.8

Inventor:
Raymond Joseph Jasse
By: Haseltine, Lake & Co
Attorneys

PUBLISHED	R. J. JASSE	Serial No.
JUNE 8, 1943.	ELECTRIC COMPENSATOR FOR PLANTS FOR LOCATING SOUNDS Filed July 1, 1942	449,539
BY A. P. C.		4 Sheets-Sheet 4

Fig. 9

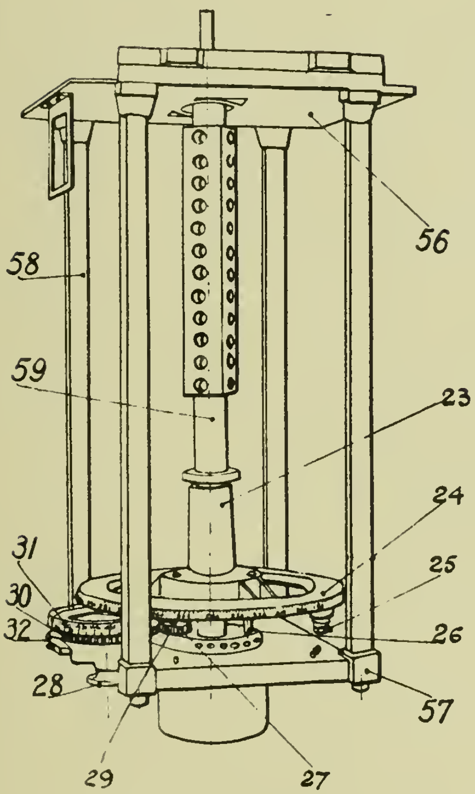
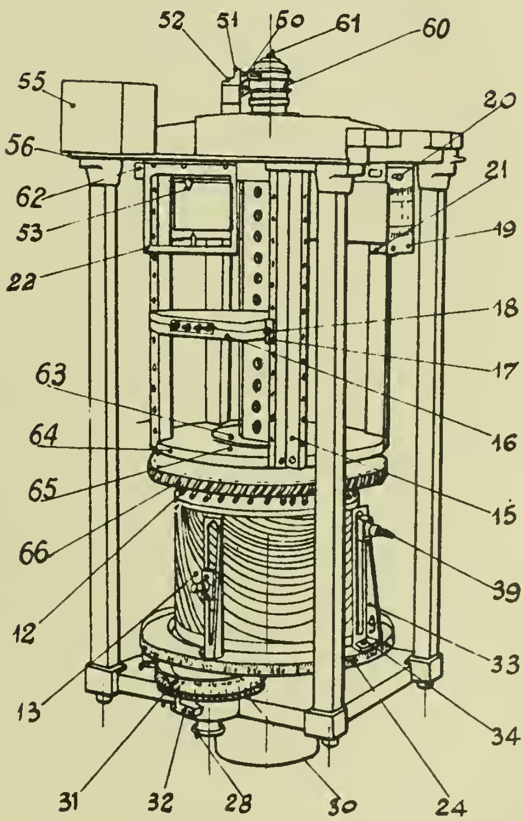


Fig. 10



Inventor:
Raymond Joseph Jasse
By: Haseltine, Lake & Co
Attorneys

Published June 8, 1943

Serial No. 450,936

ALIEN PROPERTY CUSTODIAN

ENGINED COMPRESSOR-GENERATOR UNIT

Charles Raymond Waseige, Saint-Etienne, Loire, France; vested in the Alien Property Custodian

Application filed July 14, 1942

My invention has for its object to provide an engined compressor-generator unit of small power and reduced size and weight so that it may be easily carried and lodged, more particularly on board of an aerodyne, said unit being remarkable in that in view of this object, it comprises the combination of a high speed internal combustion engine driving, on the one hand, an electric generator, either directly or through the medium of a multiplying gear, and, on the other hand, a compressor running at a less high speed, through the medium of a reducing gear.

Another object of my invention is to provide a very flat unit that may be easily lodged in an airplane along the side of a wall, as for example that of the fuselage.

A further object is to provide for an efficient cooling of the engine, compressor and other hot points of the unit such as, for example, spark plug, spent gas outlet of engine, air delivery of compressor.

A still further object is to provide an engined compressor-generator unit intended to be used on multi-engined aircrafts to supply the various needs in electric current and compressed air, thereby relieving the propelling engines from this duty.

Other objects and features of the invention will appear from the following description of a preferred embodiment of the invention and be more fully pointed out in the claims.

In the annexed drawings:

Fig. 1 is a vertical section of the unit on the line I—I of Fig. 3, i. e. in a vertical plane containing both the crank shaft axes of the engine and the compressor;

Figs. 2 and 3 are transversal sections on the lines II—II and III—III of Fig. 1, respectively;

Fig. 4 is a fragmentary section at a larger scale of an engine cylinder, showing a detail.

In this example, the unit comprises a one-cylinder engine of light weight adapted to run normally at a high speed, say of the order of 4000 revolutions per minute, for example, the cylinder **1** of which is carried by a rather deep vertical case **2**, resting in turn on a hollow base **3**; at a level somewhat higher than the latter the case **2** is provided with an overhanging extension **2a** which carries the cylinders **4** of the compressor,—the latter being here shown as of the two-stage type,—and which serves as a crankcase for the crank shaft **5** of said compressor. The crank shaft **5** is located in a common vertical plane with the crank shaft **6** of the engine and is parallel thereto; toothed wheels **7** and **8**, respectively keyed on the ends of the crank shafts **6** and **5** (the latter being at a higher level than the former), mesh together and form a reducer between the engine and the compressor. Secured on the lower portion of the crank case **2** underneath the overhanging portion **2a** is the firing magneto **9**, driven by a toothed wheel **10** meshing with the wheel **7** on the end of said engine crankshaft **6**. The other end of the latter projects out of the crank case **2** into a chamber **11** defined by said case and a housing **12** rising from the base **3**, said chamber containing a blower or fan **13** keyed on said projecting end of the crank-shaft **6**. A passage **14** opening at the lower part of said chamber **11** insures the communication between the latter and the inner space of the base **3**. The part of said chamber **11** which is in a vertical plane with the fan **13** serves as a volute-like header for said fan and merges tangentially at its lower portion with an air delivery passage **15**, in which is inserted a cock **16** (Fig. 2), said passage leading to an opening **17** in a wall **18** which, in the present instance, will be assumed to be the wall on an airplane fuselage. On the same side as this delivery passage **15** is an air intake **19** in which the oil cooler **20** is located and which is connected with an opening **21** in the same wall **18**. This air intake **19** is formed by the wall itself of the base **3**, which is conveniently shaped for that purpose and constitutes at the same time the wall of the lower part of the crank case **2**. On the end of the engine crank shaft **6** is coupled, in this instance directly, an electric generator **23** fastened onto the outside of the housing **12**.

On the other hand, the cylinders **1** and **4** provided externally with cooling fins are covered by elements forming a continuous cowling **25**, which is preferably situated very close to the aforesaid fins and merges with the wall **12** of the aforesaid chamber **11**, whose inner space thus communicates with the space existing between the crank-case, the cylinders and the cowling **25**. The latter is provided with openings forming air inlets at the point **26** most removed from the fan **13** as well as at the hottest points and more particularly at point **27** round the spark plug **28** (Fig. 4), also at point **29** in order to cool the engine valves **31**, at point **30** round the engine outlet pipe and round the delivery pipe, not shown, of the compressor.

It is obvious that, as the fan **13** rotates, a double induced circulation is organized as shown by the arrows (Figs. 1, 2 and 3), air flowing, on the one hand, through the air intake **21**, the open-

ing 13, the inner space of the base 3 and the passage 14, thus cooling the oil cooler 20, and on the other hand, through the various air inlets of the cowling 25, through the latter and round the finned cylinders of the compressor and the engine. While this air, which is delivered by the fan 13 through the passage 16, is discharged into the open air through the opening 17, in the example shown, it might as well be recovered and used, for example, for reheating the surrounding air or otherwise.

The invention is in nowise to be construed as limited to the details of construction as shown and described as these are only given as an example.

CHARLES RAYMOND WASEIGE.

PUBLISHED	C. R. WASEIGE	Serial No.
JUNE 8, 1943.	ENGINED COMPRESSOR-GENERATOR UNIT	450,936
BY A. P. C.	Filed July 14, 1942	

Fig. 1

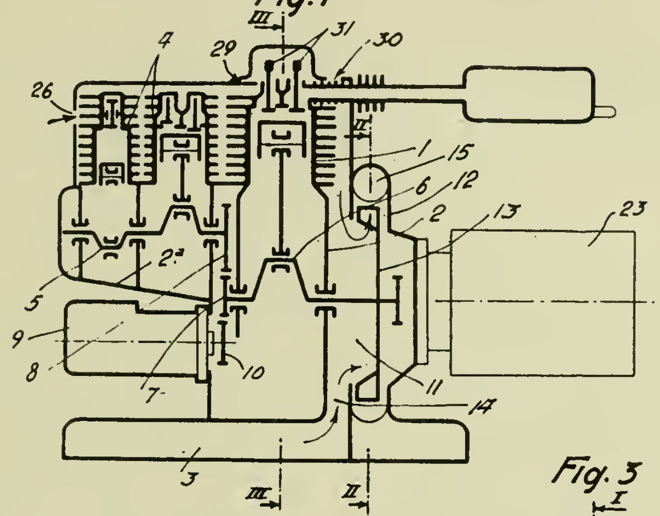


Fig. 2

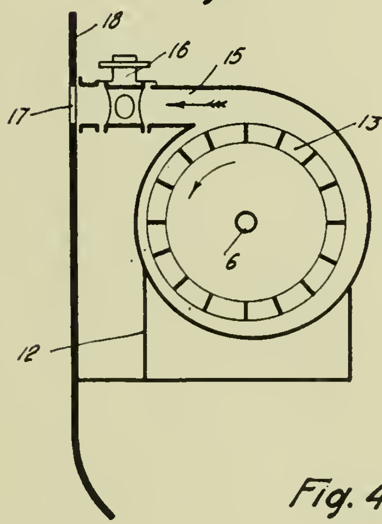


Fig. 3

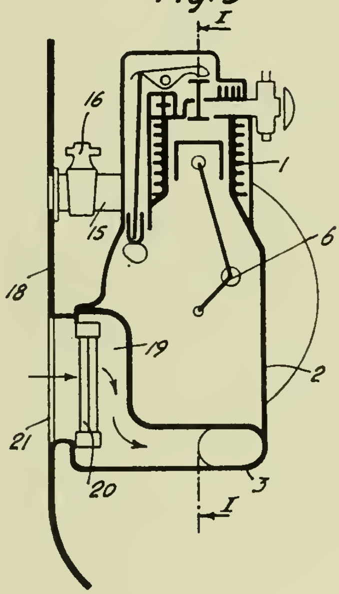
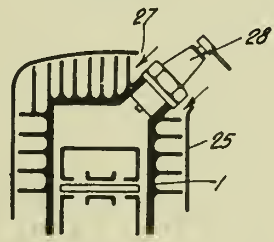


Fig. 4



Inventor
Charles R Waseige
By Glascock Downing & Seebold
Attys

Published June 8, 1943

Serial No. 455,909

ALIEN PROPERTY CUSTODIAN

METHODS AND APPARATUS FOR THE TRANSMISSION OF SIGNALS

Henri de France, Lyon, France; vested in the Alien Property Custodian

Application filed August 24, 1942

The present invention relates to methods and apparatus for the transmission of signals to a distance of the kind including, both for transmission and for reception of said signals, electronic means to which energy is fed from suitable feed sources, for instance from a reciprocating current distribution system. The invention is more especially, although not exclusively concerned, among these methods and apparatus, with these applied to television and especially television systems including mobile transmitting (and even receiving) stations.

The object of the present invention is to provide a method and apparatus of the type above referred to which ensures a more accurate reception than it was possible up to the present time, this result being obtained, in particular, owing to the elimination of the defects which are due, in the present practice, to the lack of synchronization between the feed at the transmitting station and the feed at the receiving stations.

With this object in view, an essential feature of my method consists in independently feeding reciprocating current to one of the stations and especially the transmitting station and synchronizing this feed to a standard frequency which may be supplied for instance by a reciprocating current distribution system. The synchronizing may be effected either through a cable or through radio electric means, this last method ensuring a great freedom of the independently feed station which can thus be a mobile station.

According to an essential feature of my invention, my apparatus includes an independent source of reciprocating current at one of the stations between which signals are to be transmitted and more especially at the transmitting station, a central source of standard frequency and means for synchronizing this independent feed source with said central source.

According to a preferred embodiment and especially when a plurality of receiving stations are to receive signals from a transmitting station, the central source of standard frequency and the receiving stations are all fed with reciprocating current by a common distribution system.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example and in which:

Fig. 1 is a diagrammatical view of a system according to the present invention and especially intended for television, such a system including a fixed central transmitter, a plurality of receiving stations (one of which is shown at 18 on the drawing) and a mobile transmitting station the signals of which are intended to be received by the central transmitter so as to be retransmitted.

Fig. 2 shows a portion of a system of the kind of that shown by Fig. 1, this portion being that relating to the feed of the transmitting station, this embodiment corresponding to a modification of that shown by Fig. 1.

In the following description, it will be supposed that the invention is applied to the case of a television system including a mobile transmitting station that is to say a transmitting station carried by a vehicle.

First, it must be reminded that in the systems of this kind such as they have been made up to the present time, the mobile transmitting station is fed with current from an external source, generally a 50 periods reciprocating current distribution system, which may be the same as that used for the feed of the various fixed (or mobile) receiving stations, or which may be distinct.

Such systems have the disadvantage that the field of possible applications is considerably reduced. As a matter of fact, it may be necessary to perform television transmission at places where the power of the current that is available from the distribution system is insufficient, or again at places where no plug-switch has been provided. On the other hand, television transmission can take place only when the vehicle is stationary. It is impossible when the vehicle is moving. Furthermore, it has been found that when the feed is ensured by reciprocating current (or by direct current obtained by rectification of reciprocating current) both at the transmitting station and at the receiving stations, it is necessary to ensure that the frequencies of the feed sources, at transmission and at reception, be perfectly identical and synchronized. This is necessary because if there is a phase difference between the tube heating current at the transmission station and the tube heating current at the private receiving stations, there results, on the screens of said receiving stations, a succession of moving bands alternately dark and clear and also a certain "stirring" in the direction of the lines, this result being due to the combined effect of the lack of synchronism and of the defects of the filtering means in the feed circuits.

The object of the present invention is to eliminate these drawbacks and, in particular, to permit, with a transmitting station carried by a ve-

hicle, of performing television under any conditions whatever, even when the vehicle is moving, while avoiding at the reception the defects due to lack of synchronism between the feed sources.

For this purpose, according to the invention, I proceed in such manner that:

(*a*) The mobile station (to wit, in the particular case that is being considered, the transmitting station although the invention might as well apply to the feed of mobile receiving stations) includes, independent reciprocating current feed means of any suitable type; and

(*b*) this reciprocating current (for instance of the 50 periods type) is synchronized, through any suitable means, to a standard frequency which will preferably be that of a current distribution system.

If it is supposed, as it will be the case in the following description, that the receiving stations are fixed stations in which the heating is itself ensured through said distribution systems, a perfect synchronism will thus be always obtained.

Furthermore, it is advantageous, according to another feature of my invention, to ensure synchronism to a distance through radio-electric signals, whereby the vehicle which carries the transmitting station, with its independent current feed, can freely perform any desired displacement.

A system complying with the conditions above set forth can be made in many different ways, for instance as follows:

Concerning first the mobile transmitting station carried for instance by a trailer **2** attached to a vehicle **1**, its general arrangement is of any suitable type. For instance it includes a camera apparatus **3**, the various usual television devices (supposed to be carried by the vehicle proper, **1**) and an antenna **4**.

As for the means for feeding current to said transmitting station, they are advantageously carried by a trailer **2**. They include a suitable source of energy, for instance an internal combustion engine **5** (or any motor operated by a fluid) or an electric battery. This source of energy is capable of driving or controlling an apparatus for generating reciprocating current, which apparatus may for instance be either of the electro-dynamic kind, being then advantageously constituted by an alternator **6** (Fig. 1) or of the electro static or other kind as shown by Fig. 2. In the embodiment of Fig. 2, said apparatus is constituted by a group of gas tubes or thyratrons **7**, assembled in any known manner for transforming a direct current (fed for instance by a battery or, as shown by the drawing, by a generator **8** driven by the internal combustion engine **5**) into a reciprocating current.

Concerning finally the means for synchronizing the frequency of this reciprocating current with that of the distribution system that is chosen, said means are made in such manner that, through a reciprocating current fed to a distance, transmitted through radio-electric means, then received by a suitable receiving device **9**, provided at the mobile television transmitting station, it is possible to influence one of the factors upon which the frequency of this current depends in the reciprocating current generating system of said station.

Thus I may make use of a transmitter **10** of relatively low power, located at any suitable place (for instance at the central transmission station above mentioned). This transmitter is modulated by means of the frequency of the current distribution system, which gives for instance a wave modulated to 50 periods. Then this wave is received in receiver **8**, which is fitted with demodulating means of any suitable type. At the output end of this receiver, I thus obtain a reciprocating current which is in accurate synchronism with the current distribution system. I may then utilize this current in one of the following ways:

(*a*) This current is caused to act upon a device analogous to a phase-meter which is otherwise influenced by the frequency of the current fed by the source of the mobile station, for instance alternator **6**, this device producing a voltage or a current which is a function of the phase difference and through which it is possible to control all the elements or circuits upon which the frequency of said station depends;

(*b*) the current from device **8** may also be caused to act directly upon the source of reciprocating current of the mobile station and especially when the latter is constituted by thyratrons. It is known that the discharge of such tubes can be controlled by a suitable reciprocating current, and at the frequency of said current;

(*c*) other possible ways of utilizing the current from device **8** are included in my invention.

In Fig. 1, I have shown, by way of example, a phase-meter **11** receiving, on the one hand, the sinusoidal current from receiver **9** and, on the other hand, a current from alternator **6** which is intended to feed the elements of the transmitter **12** of the vehicle. The variable current résulting from the action of the two above mentioned currents may be used for operating any mechanical, electronic, or other relay capable of modifying the speed of revolution of the alternator.

I might, for instance, act, through such a relay, either upon the fuel feed means of engine **5**, or on any electrical intermediate device influencing the control of the operation of the alternator.

It has been supposed, in the example shown by Figure 1, that the internal combustion engine **5** drives alternator **6** through the intermediate of a generator **13**, the current of which is fed to an electrical motor **14** coupled with the alternator. The current fed by the phase-meter then comes to act, either through rheostat **15** or through electronic relays, or again through other means, upon the excitation means of the generator or motor. But this arrangement is given merely by way of example and has no limitative character. In particular, I might utilise the means described in the French patent No. 869,107 filed by Mr. Yves Rocard, on September 13, 1940, and concerning the control and the adjustment of electrical motors, the means described with reference to Fig. 2 of said French patent being particularly suitable for this purpose.

In Fig. 2, I have shown an arrangement including thyrations **7**. The latter are fed with the direct current supplied by generator **8** coupled with motor **5**. On the other hand, they are controlled, in the known manner, by the sinusoidal current supplied from receiver **9**. The reciprocating voltage at the output of the thyratrons is then exactly at the same frequency as that received in said receiver.

Whatever be the particular embodiment that is chosen within the scope of my invention, I obtain a system the working of which is such that the feed of the mobile transmitting station will be always synchronized with that of the receiving stations which are supposed to be connected to the electric distribution system. It should be well

understood that this mobile transmitting station may either transmit the signals directly if its power is sufficiently great, or transmit signals intended to be received by a powerful central transmitting station which retransmits said signals, such a central transmitter being shown at **17** in Fig. 1.

The synchronizing transmitter **10** may be adjoined to this central station. In all cases, the construction according to my invention permits of fully solving the problem of mobile television stations. It ensures a perfect synchronizing between the feed of the transmitter and that of the receivers, while leaving the vehicle which carries the transmitter entirely free to move during the television process. However, when television has been performed at a fixed place, it is of course possible to obtain the desired synchronization by connecting the phase-meter or any other adjustment apparatus with the local electric distribution system through a cable.

Finally, there is always a suitable power available, to wit that provided for the source of energy mounted on the vehicle.

In a general manner, while I have in the above description disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

HENRI DE FRANCE.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

H. DE FRANCE
METHODS AND APPARATUS FOR THE
TRANSMISSION OF SIGNALS
Filed Aug. 24, 1942

Serial No.
455,909

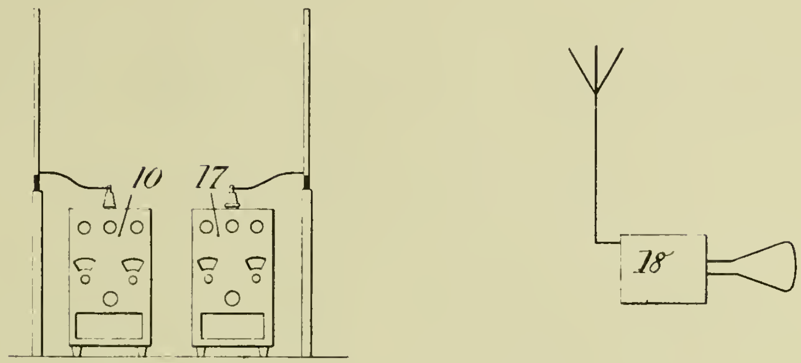
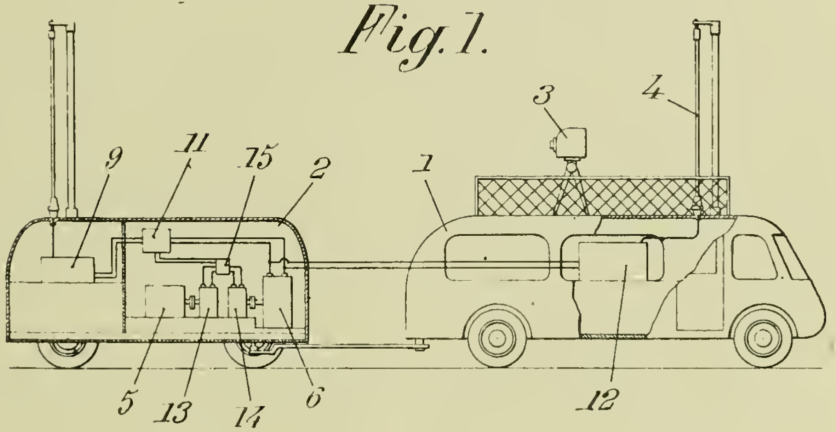


Fig. 1.



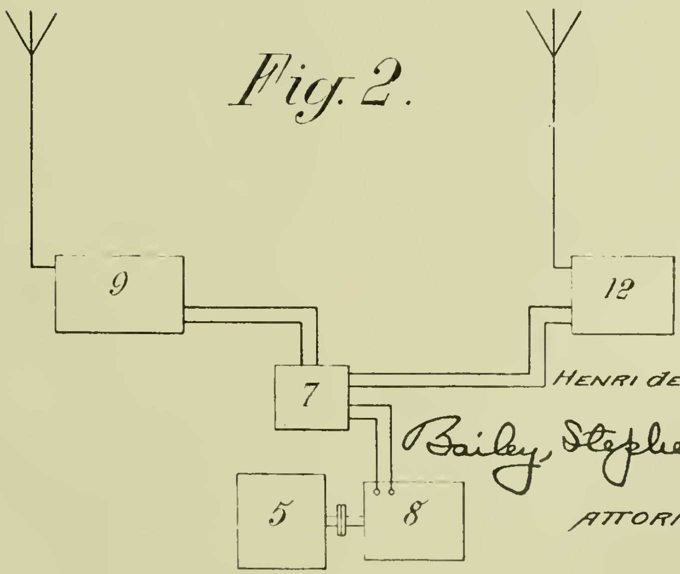


Fig. 2.

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Published June 8, 1943

Serial No. 458,607

ALIEN PROPERTY CUSTODIAN

FERMENTING PROCESS

Philippe Naldi, Lyon, France; vested in the Alien Property Custodian

No Drawing. Application filed September 16, 1942

The present invention relates to a new general method of fermenting starches, sugars and various materials inclusively cellulose-like substances hydrolised or not, the fermentation being principally but not exclusively lacto-butyric, by means of a bacteria symbiose obtained by the conjugated use of various selected species added to the bacterias of the earth and the alimentary canal of certain herbivorous animals, under others that of the Panda (*B. pandae*) exotic animals which eat bamboo-cane. On this way produces higher than that given by other processes are obtained and are conditioned by the biological characteristics and by the composition of said ferment substances especially by the presence of cellulosolytic anaërobes as well as by the operative manner which sets them to action.

In fact,

(*a*) One incorporates to said ferment substances, by suitable means and culture manners, certain selected bacterias, lactic, pseudo-lactic, butyric, cellulosolytic, pectinolitic, etc., taken from habitats which are their propers, nature, man, animals. There is given a place to the Pandae Bacterias, especially insulated and to the cellulosolytic species as well as to certain sarcines derived from plants and from dead wood. The so prepared ferment substances allow to make fermenting besides sugars and starches other substances contained in various primary substances as for instance the brans and wastes of various corns or the hydrolysates of cellulosic substances containing, besides the reducing sugars, gums, mucilages, resins, dextrines, hemicelluloses, not hydrolized celluloses, etc., as well as certain organic salts obtained by saturation of the acids present in said hydrolisates. The fermentations by these ferment substances, of the primary substances indicated herebefore are characterized by produces higher than given by only the transformation of starches or reducing sugars.

(*b*) Further the composition of these ferment substances allows to direct the bacteria activity towards obtaining various products and also, in the course of the same fermentation, to stop it at the desired phase or to continue it eventually in a later phase. As an example one indicates here the operating manner for obtaining first the lactic fermentation, butyric in the continuation, of troubled musts of the hydrolysis of cellulose-like substances.

After sowing the musts into the first phase, the lactic properly said, the pH is maintained at about 5,5 by successive additions of calcium carbonate, the temperature resting at about 50° C. When the desired final product is lactic-acid at this phase the fermenting is stopped and the solution of calcium lactate is concentrated and let crystallize and separated by filtration, airing or by any other known means.

When the desired finished products are the fatty volatile acids one proceeds to go to the second phase of the fermentation, in adding the must of a sufficient quantity of celcium-carbonate for maintaining the pH during all the duration of the fermentation between 7 and 7,5, the temperature being lowered until about 40° C.

This manner of operating consists therefore in making vary the conditions of the fermentation (concentration of the primary substance pH, cooperating temperatures, manner of acclimature in view of obtaining various products, for inst. be it lactic acid or fatty volatile acids in "tampion" condition, be it alcohols, acetone and acids, in acid condition.

Further the special composition of the ferment substances allows to draw a maximum profit in various products starting of complex primary substances.

In fact this fermentation which can clear in troubled must allows to render more economical and easy the employing of certain substances like the cellulosic residues, the wastes in the manufacture of meal, rize, oil, etc.

In a general manner these ferment substances allow a very active fermentation of the primary substances used. Their acclimation to those substances is particularly rapid. In comparison with the known industrial methods of butyric fermentation the new symbiose reduces the duration of the fermentation, even in the most difficult cases and increases for about 20% the profits. It supports more easily in the musts the presence of antisepticas which is difficult to integrally eliminate from the hydrolisates.

When in the preparation of the ferment substances the mingling of the bacterias from the diverse origins is once realized according to the process the stocks are constantly maintained in the active stage by frequently repeating setting of reserves, in mixed media, of nitrogenious and cellulosic sugars according to a manner of operating which puts to account products of fermentation desired to be obtained and primary substances desired to be treated.

For indicating but not for limiting purposes an example of sowing a raw hydrolysate of cellulose-like substances in view of obtaining fatty acids is given hereafter.

The chosen special ferment substance which,

as has been said, contains, besides other kinds, the cellulosolytic anaërobies constantly made active again, is first prepared in a culture container containing one litre of must to 10% of determined substances capable of being fermented and the necessary quantities of nourishing substances as well as the carbonate of calcium are added, this latter serving for neutralizing arising acids. The fermentation begins after a few hours. This first ferment substance will only serve the third day for sowing about 1½ litres of a second ferment substance prepared with the raw hydrolysate of cellulose-like substances. This must from which the insoluble (lignin) has not yet been separated contains for instance 70 gr. per litre of sugar reductives (principally glucose, manuose, xylose) other not reductive substances adapted to be fermented (dextrines, gums, celluloses, hemicelluloses, etc.) and quantities of diverse acids (acetic, formic, levulic, ulmic, etc.) and even traces of antiseptic substances as for instance the furfurol which is very difficult to be fully eliminated from the cellulose-like hydrolysates.

To this must, on its side, are added carbonate of calcium and, according to the case, chemical adjuvants. The litre of the first ferment substance has thus served for sowing 1½ litres of musts of hydrolysis, as here-above, for provoking the fermentation of the sugars and of other substances which are more especially transformed by the cellulosolytic anerobies present in the stocks. As has been said these stocks are industrially prepared and made active by heating and frequently repeated setting of reserves, in mixed mediums (cellolosic, sugared, nitrogenous). At the expiration of four days of fermentation these 2½ litres of mixed ferment substances can be poured into 7½ litres of new sauce of hydrolysis prepared as precedently. One has therefore in the whole 10 litres of must constituted by 25% of acclimated ferment substance and 75% of raw hydrolysate designed for the fermentation. These proportions are valuable for all industrial quantities.

The fermentation of the totality of the musts finishes at the expiration of six days.

As already stated the lacto-butyric fermentation operates without taking account of the intermediate phases, in two times the first of which gives over all the lactic acid according to the formula $C_6H_{12}O_6=2C_3H_6O_3$ and the second gives the fatty volatile acids according to the formula hereafter (expressed in butyric acid)

$$2C_3H_6O_3=C_4H_8O_2+2CO_2+2H_2.$$

In industrially operating as has been said as an example, upon the hydrolysis sauce of the cellulose-like substances and by sowing 25% of ferment substance, the total duration of the fermentation will be five to six days, instead of eight to nine days with the ferments of the earth. In proceeding as said hereabove, that is, by successive sowing, after four days of fermentation only, that is, in butyric phase, one obtains the 25% of acclimated ferment substance at a very advanced degree permits a rapid fermentation of the musts which is finished in five or six days.

There are given, by way of example, a few profit numbers for a sauce of hydrolysis for oil-graves.

Sowing with 10% of ferment substance (butyric bacteries of the earth)

Duration of the fermentation ---------- 15 days
100 kgs of reductive sugars give in
butyric acids -------------------- 55 kgs 500
With a profit % of the theory of ------- 113,5%

Sowing with 25% of ferment substance (butyric bacteries of the earth)

Duration of the fermentation ------ 8 to 9 days
100 kgs of reductive sugars give in
butyric acid -------------------- 57 kgs 100
With a profit % of the theory of ---------- 117%

Sowing with 25% of ferment substance (with the new acclimated ferment substance)

Duration of the fermentation ------ 5 to 6 days
100 kgs of reductive sugars give in
butyric acid -------------------- 68 kgs 400
With a profit % of the theory of --------- 140%

The theoretical profit in $C_4H_8O_2$ is of 48,9% of the reductive sugars. In the cited examples the higher profits with respect to the reductive sugars indicate therefore that other substances. contained in the hydrolysate, have been transformed by the bacteries made active according to the process. It results therefrom that the real profits largely exceed the theroetical profits which were to be predicted in the case where only the reductive sugars present in the musts would have gone through the fermentation.

The hydrogen and the carbonic acid of the fermentation can be recuperated and utilized for diverse industrial operations.

PHILIPPE NALDI.

Published June 8, 1943

Serial No. 458,608

ALIEN PROPERTY CUSTODIAN

METHOD OF MANUFACTURING FATTY ACIDS AND THEIR DERIVATES BY FERMENTATION OF CELLULOSE-LIKE HYDROLYSATES

Philippe Naldi, Lyon, France; vested in the Alien Property Custodian

Application filed September 16, 1942

The present invention has for its object the manufacture of fatty acids and their derivates by fermentation of clear musts or troubles arising from the hydrolyse of cellulose-like substances obtained with the appropriate ferment substances, in accordance with the French Patent Application No. 12,722 filed on January 16, 1941 and by the methods of operating disclosed hereafter.

(1) One makes ferment the troubled musts (and the more, the clear musts) obtained for instance by the acid hydrolysis of cellulose-like substances, the fermentation of the troubled musts allowing:

(a) To avoid a costly extraction of sugars.

(b) To utilize fermentable substances other than the sugars which, with any other operating manner, would rest in the insoluble and would therefore not be utilized.

One makes therefore to ferment, by the action of lactobutyric celluloselytic ferments present in said ferment substances, the sugars and all other substances other than the sugars contained in the raw hydrolysate and fermentable by my methods.

(2) One utilizes, by the method, the activating properties of the insoluble (lignin) present in the musts: even in the fermentation in clear must and addition of insoluble (lignin) plays an important part in the fermentation because this insoluble replaces wholly or partly, the chemical remedies already currently employed and allows to increase the profits and to shorten the duration of the fermentations.

In fact:

Certain substances contained in the hydrolysate others than the "oses" properly said (gums, resins, hemi-celluloses, not hydrolised celluloses, nitrogenous compounds, humates, formiates, lignins, etc.) are transformed and utilised by my ferment substances, either directly as foods or indirectly as bio-chemical catalizer.

The insoluble portion of the raw hydrolysate (lignin) increases the contacting surface of the medium with the bacterias, activates the fermentation and shortens the duration thereof, remplaces wholly of partly certain costly remedies which are employed by various authors in the fermentation processes.

In the following table are given as examples only, a few profits compared with the lactobutyrique and cellulosolytic fermentation of a clear sauce and of a troubled must of hydrolysis originating, one and the other, of the same primary substances.

Saw-dust

Clear must, in the presence of chemical remedies sowed with 10% of ferment substances

100 kgs of reducing sugars give in $C_4H_8O_2$ instead of 48 kg 900	57 kgs 200
Profit % of the theory	117,1

Saw-dust

Troubled must, without chemical remedies sowed with 10% of ferment substance

100 kgs of reducing sugars give in $C_4H_8O_2$ instead of 48 kgs 900	62 kgs 600
Profit % of the theory	128

Coarse mill-wastes

Clear must in presence of chemical remedies sowed with 10% of ferment substance

100 kgs of reducing sugars give in $C_4H_8O_2$ instead of 48 kgs 900	58 kgs
Profit % of the theory	119

Coarse mill-wastes

Troubled must without chemical remedies sowed with 10% of ferment substance

100 kgs of reducing sugars give in $C_4H_8O_2$ instead of 48 kg 900	61 kgs 200
Profit % of the theory	125

The manner of operating given for indication not for limitation, is the following: the raw hydrolysate (as it is obtained for example, by the action of dilutes acids at devated temperature and pression) is converted to the desired pH introduced into the troughs of fermentation where it is sowed by a suitable ferment substance as it has been indicated. When the fermentation is finished the residual lignin is separated from the products of fermentation by any suitable separating means. The residual lignin can be utilized either as combustible either as starting substance for the manufacture of other products.

The fermentation gas, the hydrogen and the carbonic gas, can be recovered, separated and realized.

The course of this manufacture is explained by the accompanying drawing. According to this drawing the hydrolyser **1** receives the cellulose-like substances designed for the acid hydrolysis and the vapour coming from **2**, the volatil products (furfurol, aceton, methylic alcohol, formic and acetic acids) which leave by **3** are partly recovered and separated. The complete hydrolysate is poured into the mixer **4** and mixed with

milk of lime carbonate coming from 5. This must is conveyed into the tanks 6, the fermented must is cleaned in the cleaner 7 with milk of lime coming from 8. The cleaned must is filtered in the filter-presses 9 where the lignin cakes are recovered and the filtered sauce is collected in a depot-container 10. From there it is conveyed into the evaporating apparatus 11, the evaporated sauce (syrup of lime butyrate) flowing into the depot-tank 12 is once more concentrated in a boiler 13; the boiled mass flows then into the depot-tank 14 where it is solidified by cooling. The cooked mass of butyrate of lime is pyrofied in the pyrofying furnace 15, the residue of carbonate of lime leaves the furnace by 17 whilst the vapors escape by 16 and are condensed and rectified.

For obtaining the cetones by catalysis of the fatty acids the butyrate of lime is decomposed before or after concentration by the sulphuric acid and the vapors of the fatty acid are led over the metallic oxydes in a furnace according to known methods.

Evidently, if desired, there can be stopped the manufacture of the fatty volatile acids which have known uses in the chemical industry.

PHILIPPE NALDI.

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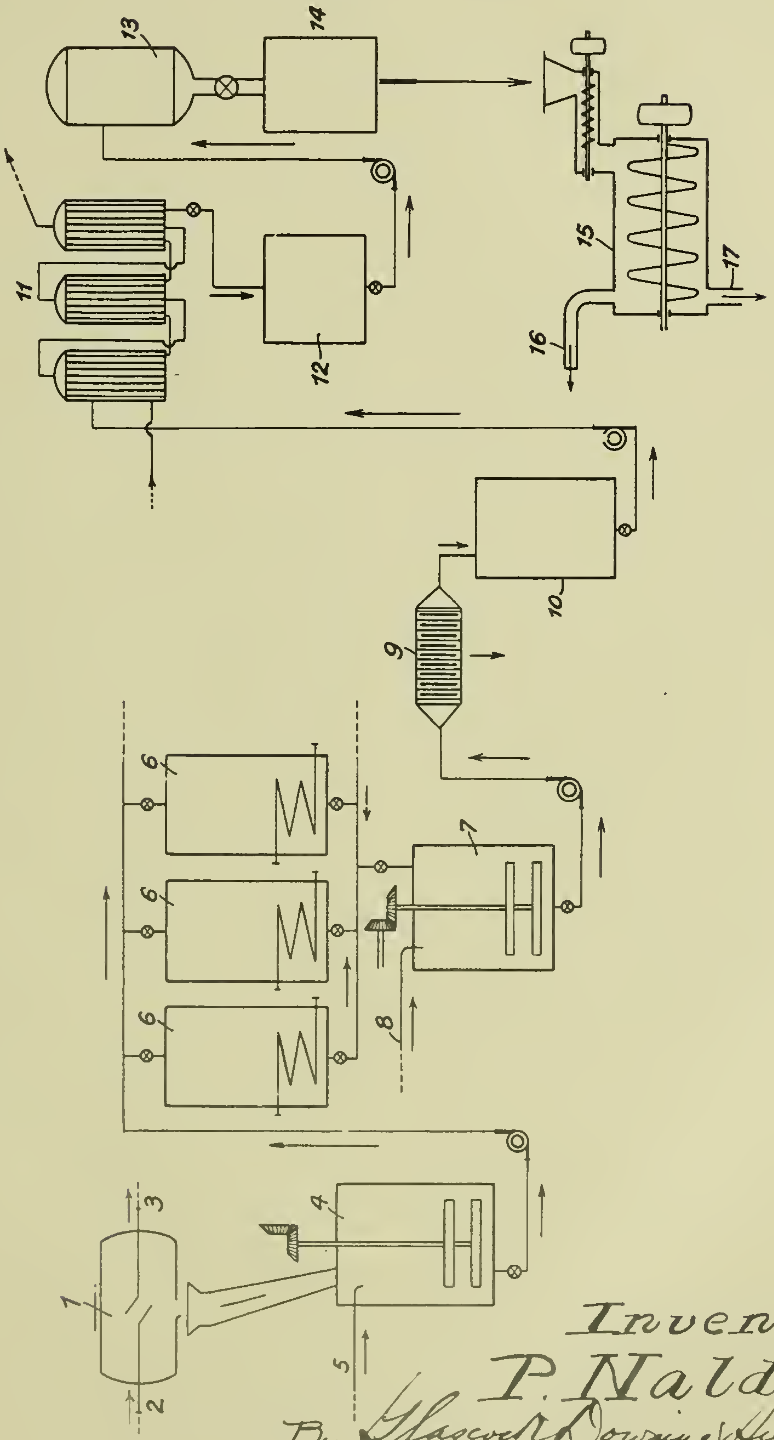
BY A. P. C.

P. NALDI

METHOD OF MANUFACTURING FATTY ACIDS AND THEIR DERIVATES BY FERMENTATION OF CELLULOSE-LIKE HYDROLYSATES

Filed Sept. 16, 1942

Serial No. 458,608



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ALIEN PROPERTY CUSTODIAN

METHOD OF MANUFACTURING FATTY ACIDS, ALDEHYDES, CETONES AND ALCOHOLS

Philippe Naldi, Lyon, France; vested in the Alien Property Custodian

No Drawing. Application filed September 16, 1942

The present invention relates to the performing of various methods, among which methods of fermenting, besides others that described in the French Patent Application No. 12722 filed January 16, 1941 utilizing the known treatment (alcalines or terreous alcalines and acids) of cellulose-like substances, in view of obtaining an ensemble of products (fatty acids, alcohols, cetones, aldehydes, lignin, coal and combustible gas) with a maximum of profit.

A course to be followed for the treatment of the cellulose-like substances by the method is given hereafter by way of example but not for limitation:

(1) The cellulose-like substances are attacked by an alcali, for instance the lime. This attack can be made either at ordinary pressure, at temperatures less than 100° C or under pressure. The duration of the operation depends from conditions of pressure and temperature and varies from a few hours for the treatment under elevated pressure to a few days for the ordinary pressure.

This first treatment can be preceded by an extraction, under vapor pressure or by solvents, of certain essences (tannins, resins, gums, etc.) contained in the cellulose-like substances. These extracts can be concentrated and find known utilizations as chemical products or be subjected to a fermentation (lacto-butyric and cellulosolytic) alone or mixed with the other fermentable substances derived from the cellulose in conformity with another patent specification.

(2) That portion (cellulose) which is not dissolved by the preceding treatment is separated by filtration, treatment in a hydro-extractor or any other known separating means.

(3) The cellulose thus separated can be sugared by means of concentrated or dilute acids at atmospherical pressure in a simplified cheap apparatus of easy construction (wood-trough for instance) or at elevated temperature and pressure and by known methods (filtering apparatus or rotatable digestor).

(4) The saccharifying finished one neutralizes by a suitable agent, for instance carbonate of calcium or of baryum and filters for separating the musts from the precipitated sulphate.

(5) To the sugared musts are added substances conveyed in their soluble conditions at the first operation, containing in solution, among other substances, the sugarates and lignates of lime, then submitted to the lacto-butyric and cellulosolytic fermentation (see French Patent Application No. 12722 of January 16, 1941) in view of the manufacture of organic acids. This fermentation sensibly increases the profit as to weight and economy of the treatment of the cellulose-like substances. It is to be noted that this fermentation can be preceded by the ethylic or acetone-butyric fermentation in clear or troubled musts for submitting hereafter the residues of distillation to the lacto-butyric and cellulosolytic fermentation.

During this fermentation important quantities of carbonic acid and hydrogen are gained.

(6) The residual lignin is subjected to the pyrogenation or to the alcaline fusion by known processes.

(*a*) The pyrogenation of 100 kg of lignin has given the following products:

56 kgs 500 of coal
14 kgs 400 of tar
0 kg 910 of acetic acid
0 kg 280 of cetone
10 kgs of water
17 kgs 910 of gas composed of—
3 kgs 020 of CO_2
10 kgs 170 of CO
4 kgs 300 of CH_4
0 kg 420 of C_2H_6

(*b*) The alcalin fusion of the lignin at 300° C with potash or soda transforms a great portion to ulmic acid—very interesting as manure—and in various organic acids. Here a few profits obtained from 100 parties of lignin treated with either by the soda or by the potash:

	By the soda	By the potash
Ulmic acid	40, 4	38, 6
Volatil acid	8, 4	8, 9
Adipic acid	-------	1, 2
Oxalic acid	3, 7	-------
Succinic and phenol carbonic acid	11, 6	10, 1
Products insoluble in alcohol	16, 2	7, 7
Volatile oils	-------	0, 6
Carbonic acids	16, 9	-------

(*c*) The lignin is firstly subjected to an alcaline hydrolysis and converted in the soluble condition, in the form of soda lignate. After concentration salted lime is added and dry distillation at 400° is performed. The lignin resulting from one ton of wood will give the following products:

Methyl alcohol ---------- 9 kgs
Cetones ---------- 22 kgs 500
Aceton oils ---------- 7 kgs

(*d*) A modification of the process described in (*c*) consists in treating the lignate of soda at

a temperature of 250–300° C in a closed vessel and to recover the volatile products, the tars and the acetate of lime.

Thus the lignin derived from one ton of wood furnishes:

	Kgs
Methyl alcohol	10 to 15
Tar	125
Soda acetate	80 to 125

Another method of operating can consist in subjecting, for instance, the cellulose-like substances to a hydrolysis acid by known means; the sugars converted in their soluble condition and the insoluble extract of the hydrolysate can form the object of diverse fermentations.

With this method of operating besides of sugars and their derivates, the destruction products of the sugars (furfurol, acetone, acetates, humates and formation of lime) are obtained. The products of the diverse fermentations furnish ethylic, butylic, isopropylic alcohols, the cetones, the hydrogen and carbonic acid.

It should be noted that the hydrogen of fermentation can, besides other matters, serve for the hydrogenation, by known means, of aldehydes and cetones and, especially, to the hydrogenation of the furfurol.

PHILIPPE NALDI.

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ALIEN PROPERTY CUSTODIAN

LACTO-BUTYRIC AND CELLULOSOLYTIC FERMENTATION OF LIQUORS RESIDUAL IN THE MANUFACTURE OF PAPER PASTE

Philippe Naldi, Lyon, France; vested in the Alien Property Custodian

No Drawing. Application filed September 16, 1942

The present invention relates to the realization of various organic substances present in the liquors residual in the manufacture of the paper paste whatever may be the treatment (by soda, in sulfite or any other) by the lacto-butyric and cellulosolytic fermentation of said liquors.

It is known, in fact, that these liquors contain, besides mineral substances, important quantities of organic products of which a great part is fermentable according to the methods described in the French Patent Applications No. 11,722, filed January 16, 1941, No. 12,726 filed January 17, 1941 and No. 12,730 of January 20, 1941.

Thus, for example, by the method with soda, by about 100 kgs of wood 500 litres of liquor are obtained, containing 20 to 25 kgs of combined soda or in excess about 70 kgs of organic substances.

These organic substances are constituted by the lignin, divers glucids, resins, etc.

The sulphitic liquors on the other side, contain by litre:

	Gr.
Lignin	80
Divers organic substances	70
Combined sulphuric acids	31
Combined lime	13

These organic substances are fermentable in the presence of lacto-butyric and cellulosolytic ferment substances according to the methods described in the already cited French Patent Applications No. 12,722, 12,726 and 12,730 and transformed to volatil fatty acids, these letters can give cetones by known methods.

The operating method consists essentially in transforming the solution to the desired pH either by acidification in the case of alcaline liquors or by alcalinisation in the case of sulphitic liquors, or still by diluting the solution until to the desired pH and adding fermentable substances coming from another source in a quantity sufficient for bringing the solution to the concentration optimum in fermentable substances.

By way of example, a ton of wood having furnished to the paper industry 450 kgs of cellulose, gives 3600 litres of residual sulphitic liquors of the composition given above. Subjected to the fermentation by the process and the later cetonisation these liquors furnish 60 litres of cetons, whilst the ethylic fermentation of sulphitic liquors gives only about 36 litres of alcohol.

PHILIPPE NALDI.

[illegible]

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ALIEN PROPERTY CUSTODIAN

ARTIFICIAL RESINS

Erich Cohnhoff, Saint Marcelin, France; vested in the Alien Property Custodian

Application filed September 29, 1942

The invention relates to artificial resins and is described more particularly in connection with artificial resins of aldehydo-phenolic nature.

It is known that resinous products in course of their manufacture pass through three different stages:

The first stage, state A, which follows immediately the condensation of reacting substances corresponds to a viscous fluid formed by a colloidal aqueous solution of resin. This first stage is extremely unstable and tends to be converted into a second stage, state B, corresponding to a solid substance soluble in organic solvents, namely in alcohol.

The third stage, state C, which corresponds to a final and solid form of artificial resin, is obtained by subjecting the second stage to simultaneous action of heat and pressure.

One object of the invention is to eliminate the difficulties encountered in the manufacture of artificial resins due to the impossibility of stopping the reaction of condensation when said reaction has been primed, i. e. to stabilise the state of the product which, in case of aldehydo-phenolic resins corresponds to an aqueous colloidal solution, at the state A.

Another object of the invention is to stop the reaction giving place to the formation of artificial resins by the addition of a stabiliser, such as of tannin, for getting an aqueous colloidal solution of resin which is stable below a certain limit of temperature.

In the particular case of artificial resinous products prepared by condensation of phenols or cresols with aldehydes, this stabilisation enables to get an aqueous aldehydo-phenolic solution either from rectified and purified phenols or cresols, which corresponds to the conventional process used in practice, or what is much more important, in accordance with one of the objects of the invention, by carrying out the reaction, not from purified and rectified phenols or cresols, but from industrial by-products namely from crude coal or wood tar.

The invention can also be applied to the manufacture of artificial resins by ureo-formolic condensation which also enables to stabilise an aqueous colloidal solution at a determined stage.

Another object of the invention is to apply the stabilisation of the resinous product to any reaction of condensation of similar type, whereby the tannin, or any other substance having the same properties, apparently acts as a protector of the colloidal substance in aqueous solution.

The particular interest of this stabilisation, for example in connection with aldehydo-phenolic resins, consists in obtaining an aqueous colloidal solution of any desired degree of viscosity stabilised at the state A, thus enabling to use said resins for new purposes, or in old fields but under more advantageous conditions. In accordance with the foregoing, still another object of the invention is to eliminate in a series of industrial applications the dissolution of resins in organic solvents such as in alcohol, and replacing this alcoholic liquor by a colloidal solution of resin in water.

The invention enables to get any desired degree of viscosity of colloidal aqueous solution of resin either by extraction or by addition of water or of any other suitable solvent.

The stabiliser can, for instance, be used in proportions comprised between 0,5 to 30% depending on the nature of the stabiliser, the substances of reaction and the manufacture of product.

The above objects and other objects of the invention will be apparent from the description of several examples given below with reference to a drawing illustrating one embodiment of carrying out the invention in application to the manufacture of sticking films.

Example I.—Obtention of aqueous colloidal stabilised solution

Crude tar, for instance coal tar, is introduced into a metallic container provided with a double wall space, a mixing device and a heater.

The temperature of the tar is first brought to 40° C, while continuing to mix and when the tar has got a sufficient fluidity there are added for:

	Parts
Coal tar	100
Formaldehyde (tenor 40%)	30
Hexamethylenetetramine	2,7
Ammonia 25° Bé	1,6

The proportion of formaldehyde with respect to the tar is obviously calculated according to the tenor of the tar in phenols.

The temperature of the mass is then brought to about 70° C while taking necessary precautions in order under no circumstances to exceeds this temperature. There are added 2, 3 parts of tannin and the mass is mixed in order it becomes and stays completely homogeneous.

The heating is then shut off and a current of cold water is then circulated through the double wall space. When the temperature has dropped to 30° C., the mixing is stopped.

After a certain time, the mass in the container is divided into two layers which can be separated one from the other by decantation.

The upper layer is fluid and is formed by an aqueous solution of aldehydo-phenolic product of condensation at the state A stabilised by the addition of tannin. The lower layer contains all the other substances which are present in tar coal without the latter having been subject to any transformation with respect to their original state. Only the substances containing a free group OH take part in fact in the reaction of condensation, and the other substances, as stated above, are found in the lower layer.

The substances present in the lower layer (pitch, anthracene, naphthalene, etc.) can be used in the conventional manner.

The upper layer containing the product of aldehydo-phenolic condensation stabilised at the state A in aqueous colloidal solution can afterwards be treated in different manners described more fully hereinafter.

Instead of using the by-products of distillation of coal, there can be used in accordance with the invention pitchy by-products of distillation of wood, containing gayacol, without having separated the latter. These products will be designated hereunder "crude gayacol".

Example II.—Utilisation of the stabilised colloidal aqueous solution for the preparation of moulding powder

For the preparation of moulding powder the colloidal aqueous solution stabilized at the state A can preferably be treated in the two following manners:

(1°) The colloidal aqueous solution stabilised according to my invention is poured into a container provided with a mixing device and with a heater. The liquid is first brought to a preferably low temperature, for instance to 63° C under atmospheric pressure, or under vacuum, in order to eliminate the excess of water.

When the mass has get the consistence of a syrup, the temperature is raised up to 100° C, while continuing to mix. This increase of temperature has as result to destroy the stabilisation of the colloidal aqueous solution at the state A and causes conversion of the resin to the second stage (state B). The resulting product is then treated in the usual manner.

(2°) This way of operation takes advantage of the property of stability of the colloidal aqueous solution prepared according to my invention.

There are incorporated into the solution in question products with which are artificial resins filled in the conventional manner, for instance: wood flower, textile fibers, fibers of any nature such as mineral fibers, dyes, pigments, etc.

There can also be contemplated the incorporation of new fillers, the use of which would become possible precisely due to the fact that incorporation of the fillers is carried out in aqueous solution, and not to the product at the state B, as it has been practiced until now.

It is pointed out that the fillers used as well as the plastifiers should not destroy the colloidal system of the aldehydo-phenolic solution.

When the additional products have been incorporated at a temperature below 40° C in the required proportions, the operation is carried out as follows:

The mass is mixed so as to form a mixture as homogeneous as possible and in order the fillers be well impregnated by the aqueous colloidal solution. The mixing is continued constantly while the temperature is slowly raised until there is obtained a substance having the consistence of a syrup.

When the temperature attains 100° C, a conversion of the aqueous solution takes place which is transformed into the state B. When this conversion is considered to be sufficient, the mixture is poured into containers, preferably shallow ones, from which after cooling, there are withdrawn plates which after pulverisation provide a moulding powder ready for use.

The advantage of this process with respect to the conventional practice is to suppress the recourse to an expensive equipment required for the incorporation of filling substances to the resin in state B, and to realise an economy of considerable power required for actuation of this equipment.

Example III.—Utilisation of the colloidal aqueous solution for various purposes

The viscous fluid prepared according to the invention can be advantageously used for the following manufactures:

Insulation varnishes,
Dye varnishes,
Impregnation of wood,
Impregnation of textiles,
Sticking films, etc.

being expressly understood that the above enumeration is given only as an example and should not be considered in a restricting manner.

According to the prior practice, the resin in state B is used generally in the form of alcoholic solution. The use of these solutions presents numerous drawbacks, the chief of which are the following ones: Inflammability, high cost price on the one hand due to the impossibility of recuperation of the solvent and on the other hand due to the high cost of this recuperation, finally danger due to the action of the alcoholic or other solvent on the material treated thereby.

These drawbacks are eliminated by the use of the colloidal aqueous solution stabilised at the state A in accordance with my invention.

It is pointed out that it is possible to incorporate into this solution all the products, fillers, dyes, pigments, etc., necessary for getting the final products having the properties required for their use, being understood that these products of addition should not destroy the colloidal system of the aqueous solution.

A particularly interesting application of the invention consists in impregnating a support in order to obtain a sticking film. This application is described hereunder:

Example IV.—Utilisation of the colloidal aqueous solution for the preparation of sticking films

The process of manufacture of sticking films consists chiefly in impregnating or coating a support, which may preferably be formed by paper, or which can be of any other cellulosic or textile nature, by using as impregnation or coating substance, the colloidal aqueous solution either of aldehydo-phenolic nature, or of any other type, enabling the application of the process of stabilisation according to the invention.

In order to disclose more fully the application of the aqueous colloidal solution stabilised at the state A, one of the following formulae can be used:

(1)

Crude gayacol	43,75
Formaldehyde (tenor 40%)	45,16
Hexamethylenetetramine	5,49
Ammonia 25° Bé	1,76
Tannin	3,84
	100,00

(2)

Crude cresol or phenol	42,86
Formaldehyde (tenor 40%)	46,23
Hexamethylenetetramine	5,35
Ammonia at 25° Bé	1,78
Tannin	3,78
	100,00

(3)

Crude cresol or phenol	42,86
Formaldehyde (tenor 40%)	48,25
Hexamethylenetetramine	5,33
Ammonia at 25° Bé	1,78
Tannin	1,78
	100,00

In each of the cases corresponding to the three above formulae, the products are treated by the same process as that described in the first example in order to get a colloidal aqueous aldehydophenolic solution stabilised at the state A intended for impregnation of the support used for the manufacture of sticking films.

This solution is then used as indicated hereunder:

For obtaining a sticking film on a suitable support it is possible to proceed either in a conventional manner, or preferably there are used certain means adapted for application of a layer of resinous substance other than that described above.

The deposit of the resinous solution is affected by means of a machine the structure of which will appear by referring to the enclosed diagrammatical drawing:

The support **4** wound on a roller **1** passes between rollers **2**, **3** and **6** mounted to assist the withdrawal of the support and its passage through a container **5** filled with a resinous solution.

At the exit from the container **5** where takes place the impregnation of the support, which can then becomes very frail in case it is formed by paper, the latter enters into chamber **7** and passes between two rollers **8** and **9** made of wood, fiber, ebony, rubber or any other material with the exception of metal, the aim being to use a substance having a low thermic conductibility, and also having a certain elasticity, so as to avoid the risk of rupture of the film.

The film continuing its travel is supported on its way in the chamber **7** by a series of rollers **10** arranged in succession and heated either individually or by the heat kept in the chamber **7** which is preferably coated with a substance of low thermic conductibility.

At the exit from the chamber **7**, the film which has been subject of required conversion became dry and solid, and can be wound without any difficulty on the reception roller **11** on which it is stored ready for use.

The temperature in the chamber **7** or of the rollers **10** as well as the speed of progression of the film may be adjusted in such a manner that the conversion of the product of impregnation from the state A to the state B be finished before the exit of the chamber **7**. In case of a colloidal solution prepared according to the Example 1, the temperature to be kept is about 96° C., and the speed of progression of the support corresponds to a duration of passage in the chamber **7** of about two minutes.

It is pointed out that the drive of all the rollers should be realised in such a manner that the film is withdrawn at a speed identical in all the parts of the machine in order to avoid a rupture of the support.

A sticking film prepared according to the invention by the use of colloidal aqueous solution stabilised at the state A, and manufactured by means of the machine described above presents a series of advantages, the chief of which are the following ones:

(*a*) The presence of tannin chosen in this case as a stabiliser, assists the penetration of the glue into the superficial layers of the object to be connected one with the other, particularly in case of wood. The temperature of glueing can therefore be lowered to 102° C., and even less and the time during which it is necessary to apply pressure to said objects can, for instance, be lowered to 9 minutes. It is recalled that in case of glue prepared by means of an aldehydo-phenolic resin at the state B and of a solvent, the temperature should be about 130° C. and the time of applying pressure about 12 minutes.

(*b*) The use of an aqueous solution eliminates all the drawbacks inherent to high cost and the dangers existing in case of use of alcoholic or similar solutions.

(*c*) The support of the film formed by suitable cellulosic material disappears in course of the utilisation of the sticking film.

A particularly interesting application of the sticking film consists in the manufacture of ply wood of any amount of sheets. A sticking film can be inserted between each sheet of wood and the resulting assembly is subjected to a pressure of about 10 kilos per square centimeter at a temperature of about 102° C. The conditions of pressure and temperature may vary in accordance with the nature of the wood and the result to obtain, the operation being extended to a period of time sufficient to bring, to a suitable temperature, the assembly to be glued.

It is expressly understood that the invention is not limited to the examples described above and that other numerous embodiments will appear to the men skilled in the art within the scope of the invention.

For the manufacture of sticking films the substance enabling a reduction of pressure and a decrease of temperature during the operation of glueing, can be different from the stabiliser used for stopping the aldehydo-phenolic reaction of condensation at a determined stage.

The substances adapted to decrease the pressure and temperature of glueing can also be added to a solution of resin in an organic solvent and which does not include any stabiliser.

ERICH COHNHOFF.

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E. COHNHOFF

ARTIFICIAL RESINS

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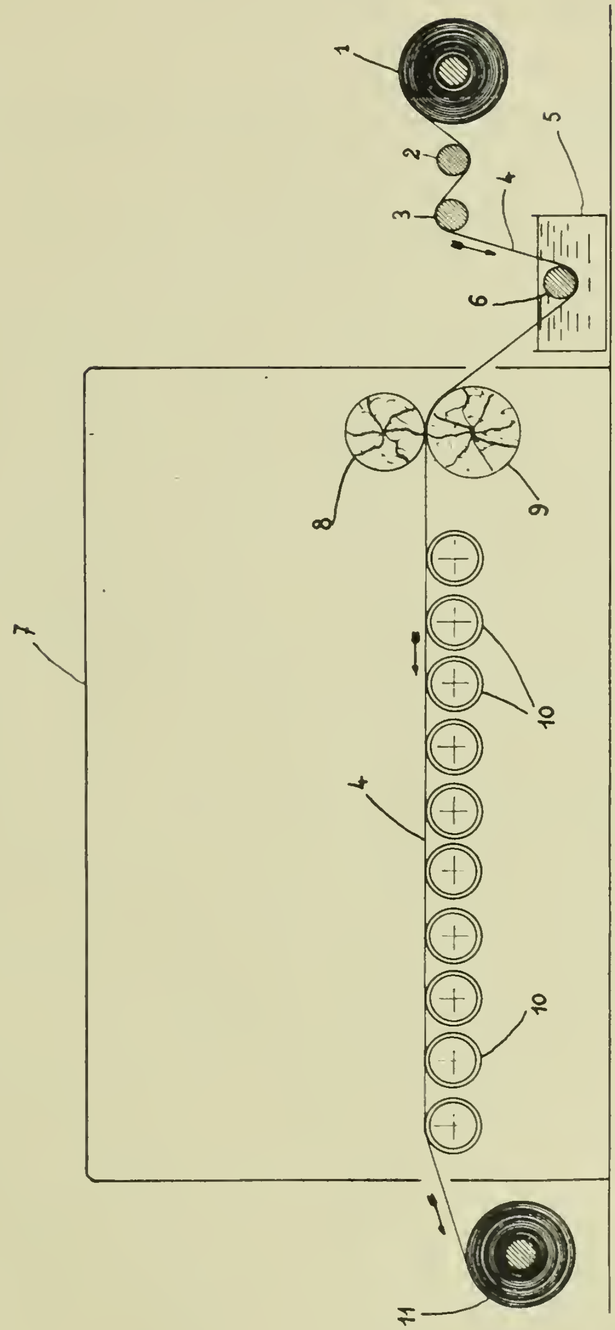

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By

N. D. [illegible] Attorney

Published June 8, 1943 Serial No. 460,231

ALIEN PROPERTY CUSTODIAN

CIRCUIT BREAKERS

Aimé Estienne, Lyons, France; vested in the Alien Property Custodian

Application filed September 30, 1942

In circuit-breakers in which the contacts are separated in a liquid such as oil for instance, the extinguishing arc causes the formation of vapors which provoke the displacement of an important mass of liquid. The motion of this mass, called "oil piston," in the extinguishing chamber, produces considerable stresses which are transmitted to the fixing and supporting elements of the extinguishing chamber. In circuit-breakers with a small oil volume, these stresses are most prejudicial because of the fact that the most detrimental stress occurs generally in an upward direction, and in the apparatuses of the type in question, for outside mounting, the extinguishing chamber is usually supported by insulators made of a ceramic matter and having a low rupturing-rate when tensioned.

The purpose of the present invention is to reduce the stresses which the supporting insulators of circuit-breakers with a small oil-volume, are subjected to. Its aim is a circuit-breaker of this type chiefly characterized by devices which allow part of the liquid mass contained in the extinguishing chamber to move towards the chamber supporting insulators, when the breaking occurs and before getting away from it under the action of gases formed by the extinction.

According to a preferred form of the invention, this motion of a part of the liquid mass is performed in opposition to the antagonist stress made upon the extinguishing chamber by either a mechanic or another adequate device.

As non limitary examples, the drawing shows several forms of performing the invention.

In Fig. 1 the upper part shows (raised plan and section) a circuit-breaker, the extinguishing chamber of which is made movable with regard to its insulating support and the lower part of said Fig. 1 shows the circuit-breaker in its half-transversal section according to plan x—y. The supporting insulator, marked out by 1 holds a porcelain cylinder 13 inside which the Bakelite extinguishing chamber 2 is inserted. The latter is filled with oil and contains an extinguishing pot 12 fixed to chamber 2 and traversed by the movable contact. This chamber is supported by a spring 3, resting on the insulator 1 and the force of which has been so chosen that it balances the weight of the chamber and allows the latter, when it undergoes internal pressures produced by the rupturing arc, to move a few centimeters coaxially with the insulator 1 and the external cylinder 13. In order to guide said displacement, guiding fingers 15 and 16 forming two crowns are set inside cylinder 13 on its lower and upper parts.

The space between cylinder 13 and chamber 2 is filled with oil and the very small diameter openings 20 through the lower part of chamber 2 balance the oil level in chamber 2 and in the external cylinder 13 without any quick pressure-waves produced by the electric arc being transmitted to the said cylinder.

The circuit-breaker fixed contact marked 8 placed at the bottom of the extinguishing chamber 2, under the extinguishing chamber 12 and the movable contact is made of a rod 9 driven by a two armed lever 10. The circuit breaker is shown in its open circuit position; in order to close the circuit, lever 10 is turned in the direction of the arrow by any unrepresented mechanical means.

On circuit-breaking, the arc taking place between contacts 8 and 9 vaporizes a part of the oil in the extinguishing chamber 2 and the stresses caused by the displacement of the "oil piston," generally takes the form represented by the curves of Fig. 2. These stresses, shown in ordinates are given with respect to the time represented in absciss. The stresses exerting on the upper bottom of the extinguishing chamber are represented by curve a, those exerting on the lower bottom, by curve b. Their difference, corresponding to resultant stresses applied to the extinguishing chamber is represented by curve c.

On circuit-breaking, chamber 2, under the action of stress $F1$, makes at first a downward displacent compressing spring 3; the stress transmitted to insulator 1 corresponds only to the spring compressing stress. On account of the inertia of the oil mass set in motion, when the displacement has reached a few centimeters, the applied strain changes of direction, first brakes the downward motion of the chamber, stops it, and after the second peak F_2 (Fig. 2) it brings it back to its state of equilibrium, with a few slight oscillations as shown by curve of Fig. 3, which represents in ordinates the extinguishing chamber motion with respect to the time represented in absciss. The inertia of the extinguishing chamber is used thus to damp the quick variations of stresses produced by the "oil piston."

Fig. 4 represents another mounting in which the elasticity of an air layer 21, provided for at the lower part of the extinguishing chamber, has a similar action as spring 3 in the device represented in Fig. 1. The oil situated in 22, at the lower part of the air chamber 23 communicates with the oil contained in the extinguishing cham-

ber through openings 24 having a large section, much superior to that of the equilibrium apertures 25. The advantage of this device is of maintaining in a fixed position the extinguishing chamber, but the stress transmitted to the supporting insulator is somewhat more important. One can reduce this stress to a minimum in providing air volumes on the upper part in 27, and at the lower part in 21, said air volumes being in inverse ratio to the distance from the ends of the extinguishing arc to the nearest oil level.

Fig. 5 shows another mounting which makes it possible to reduce to the minimum the stress transmitted to the supporting insulator, to maintain the optima conditions of extinction and to do away with spring 3. At its lower part, the extinguishing chamber is provided with a tight float 28 which makes it rise out slightly above the oil level. One could as well place the float at the upper part of the chamber or around it. The guiding is obtained in a proper manner as in device of Fig. 1; but this device requires two oil levels, independent, for the external cylinder 13 and the other for the extinguishing chamber 2.

In any of the above-mentioned devices, the driving-elements of the movable part are fixed at the upper part of the supporting insulator. The motion of the movable rod being determined and the lower contact being connected to extinguishing chamber displacing itself downwards in devices represented by Figs. 1 and 5, the latter ones have the advantage of increasing slightly the relative speed of opening.

AIMÉ ESTIENNE.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

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CIRCUIT BREAKERS

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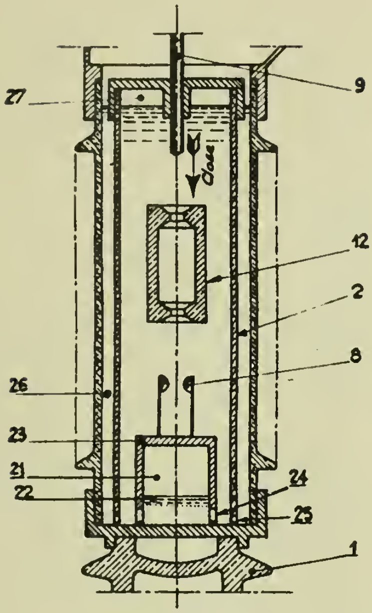

Fig. 4

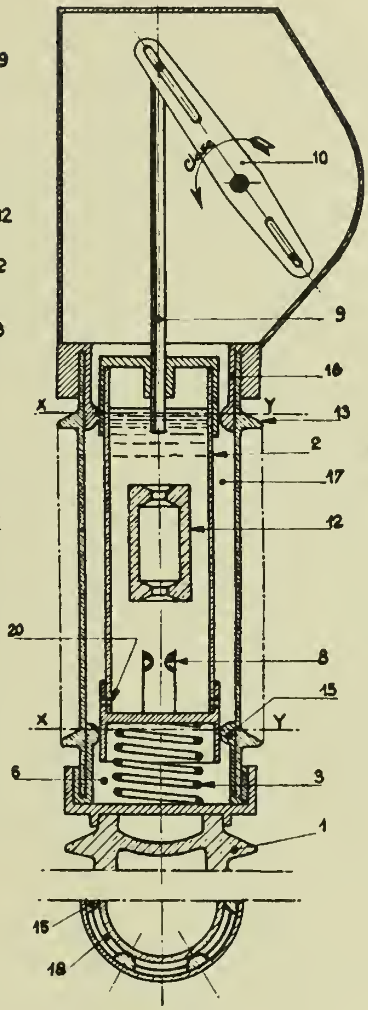

Fig. 1

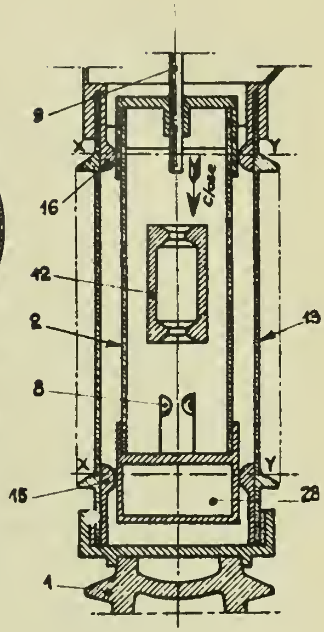

Fig. 5

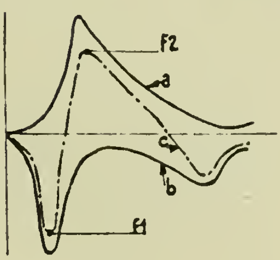

Fig. 2

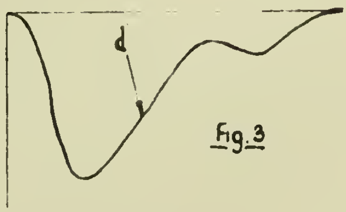

Fig. 3

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Published June 8, 1943

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ALIEN PROPERTY CUSTODIAN

CRANE

Andre Faure and Antoine Faure, Firminy, France; vested in the Alien Property Custodian

Application filed October 15, 1942

This invention relates to cranes and more particularly to cranes having a span adjustable between wide limits and is concerned more specifically though non exclusively with those cranes wherein the span may be varied by shifting the lifting point of the load.

One disadvantage of existing cranes particularly those used for lifting materials such as ashlars, girders or joists in the erection of buildings is that the crane operator must remain in a cabin positioned in some cranes at the base of the crane thereby preventing said operator from perceiving the correct position where the load has to be discharged or, in other cranes, midway or at the top of the crane mast, this involving danger for the operator and subjecting him to tiring strains due to jerks and oscillations of the mast during service operation of the crane.

A primary object of the invention is to provide a novel or improved adjustable span crane avoiding the aforesaid disadvantages and incorporating safety means whereby the risk of accidents due to breakage or collapse of the crane may be obviated or minimized where an attempt to lift a load exceeding a prescribed limit consistent with span is inadvertently made.

Another object of the invention is to provide an improved crane as aforesaid wherein the safety means involve the utilisation of those unbalanced conditions which may arise between jib and counterjib due to an unduly large load for stopping the lifting action either by declutching the prime mover from the hoisting gear or by causing said gear to come to an inoperative position.

A further object of the invention is to provide an improved crane as aforesaid wherein the jib and counterjib instead of being united rigidly to a stationary point on the mast head are connected to a lever pivoted to said head, the rocking motion of said lever due to a tilting stress on the jib being transmitted by tripping means so as to instantaneously bring about the required declutching action.

A still further object of the invention is to provide an improved crane as aforesaid particularly utilisable for handling materials used for the erection of buildings and having a structure permitting the crane operator to stand on a floor of the building being erected or on an adjacent scaffolding at the most favorable spot for manually controlling the operation of the crane, this possibility being largely due to the provision of the prime mover at the base end of the central mast of the crane and to the arrangement of adjustable controllers having means such as operating handles movable along bars extending throughout the height of said mast.

Still a further object of the invention is to provide an improved crane as aforesaid wherein the several operations such as angularly adjusting the jib, raising and lowering the load, and varying the span are ensured by a common prime mover located in the lower region of the crane mast and through clutches and gears operable from said adjustable handles.

And a still further object of the invention is to provide an improved crane as aforesaid wherein variation of the load-carrying span is controlled through a drum arrangement whose axis is coincident with the pivotal center of the mast head.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel construction, combination and arrangement of parts that will now be described in detail with reference to the accompanying diagrammatic drawing illustrating a convenient embodiment of the same and forming a part of the present disclosure.

In the drawing:

Figure 1 is a fragmentary detail view showing the mast head mechanism of a crane according to the invention, wherein variations of the load-carrying span is obtained by means of a carriage traversable along a horizontal jib.

Figure 2 is an isometric view showing the crane mast and operating and controller means associated therewith.

Figure 3 is a view showing on a much smaller scale the crane in its entirety, many parts being omitted for the sake of clearness.

As illustrated, the crane jib **2** which has a lattice structure is hinged at **2'** to the mast head **3** revolubly supported between rollers **5**. The counterjib **6** also of lattice structure is fitted with a counterweight **7** and is also hinged at **6'** to the mast head **3**.

Tie or guy rods or wires **8**, **9** connected to the jib and counterjib respectively are fastened to a cranked lever **10** pivoted at one end **11** to the top of the mast head and having its stroke limited in both directions by abutments (not shown). The other end of the lever **10** is forked and operatively connected to an upstanding hollow tripping shaft **12**.

The jib **2** supports a traversable carriage **13** operated by a cable **14** (hereafter referred to as the "second cable") passing over jockey pulleys **15**, **15**. This cable is driven by a transmission (hereafter referred to as the "secondary trans-

mission") which includes a drum 16 actuated through a bevel gear 17 by an elongated sleeve 18 loosely surrounding the shaft 12 and actuated in turn through a straight gear 19 by an upstanding shaft 20. This shaft extends throughout the height of the lattice crane mast 21 (Fig. 2) and is provided at its lower end with a reverser 22 comprising a bevel gear and a clutch of known type. Said reverser is controlled by a suitable rigging 23 linked to and operated by a controller bar 24 extending along the mast 21, said bar being fitted with an operating handle 24′ clamped thereto by an adjustable bush 24″.

The drum 16 which drives the cable 14 for traversing the carriage 13 may be formed with a groove for holding said cable. Alternatively, the cable 14 may be so wound as to form several convolutions on the drum 16.

The hoisting cable 25 (hereafter referred to as the "first cable") is secured at one of its ends at 26 (Fig. 1) to the outer end of the jib 2 and carries a hook 27 forming a load grapple. Said cable passes at the top end of the mast head over an overhead pulley 28 and then extends downwardly through the hollow shaft 12 and mast 21. The lower end of the cable 25 is secured to a winch 29 or a similar actuator which may comprise, as shown, fast and loose pulleys 30 forming a clutch and operated by a rigging 31 operated by an upwardly directed controller bar 32 extending along the mast 21 and provided with an operating handle 32′ clamped to said bar by an adjustable bush 32″.

In order to permit the mast head 3 to be revolved upon its supporting rollers 5, said head 3 is rigidly girdled by a toothed ring 34 meshing with a pinion 35 actuated by an upstanding shaft 36 extending down to a declutchable reverser 37 similar to the reverser 22. Said reverser 37 forms part of a transmission (hereafter referred to as the "primary transmission") and is operated through a suitable rigging 38 and controller bar 39 from an operating handle 39′ clamped to said bar by an adjustable bush 39″.

A single prime mover 41 constituted for example by an electric motor located at the bottom end of the mast 21 drives the winch 29 and the reversers 22, 37.

The controller bars 24, 32 are linked at their upper ends through a tumbler 42 to a fork 43 embracing a portion of the central shaft 12 defined between a pair of flanges thereon and thus operatively connected to said shaft so as to respond to its axial displacements, the latter causing the tumbler 42 to rock about its axis and to impart a translatory motion to the controller bars 24, 32.

It will be understood that the operating handles 24′, 32′, 39′ can be moved along their respective carrier bars 24, 32, 39 owing to the provision of the adjustable bushes and may be clamped thereto at any suitable position so as to suit practical requirements responsive to the particular work to be effected by the crane in each instance, e. g. to match the progress of erection of a building in a yard served by this crane. As shown in Fig. 3, this crane is assumed to be of the travelling type and comprises a base carriage 44 having wheels 45 for rolling on rails such as 46.

The foregoing possibility is illustrated in Fig. 3 which shows diagrammatically a building in the course of erection, assuming three floors to have already been laid and the crane operator to stand on the uppermost floor whence he can readily supervise the work and control the operation of the crane by means of the operating handles 24′, 29′, 32″ which are assumed to have been preset on their respective bars 24, 29, 32 to a corresponding level.

The operation of the crane will be readily understood from the foregoing without requiring additional explanation so far as the raising of the hook or grapple 27, the traverse of the carriage 13 along the jib 3, and the rotation of the mast head 3 upon its rollers 5 are concerned.

The safety device incorporated with the crane assembly operates as follows:

Assuming an unduly heavy load to have been grappled by the hoisting hook 27 and a lifting stress to be exerted on it through the cable 25, it will be understood that the balance between jib 2 and counterjib 6 will be broken, whereupon the jib 2 at once tilts to a slight extent, thus pulling the tie rod 8 and rocking the lever 10 clockwise as shown by the arrow x in Fig. 1. This moves the vertical shaft 12 down and through the fork 43 operates the tumbler 42, thus moving the bar 32 as though it were manually controlled by the operating handle 32′. As a result of this, declutching takes place and the winch 29 is brought to a standstill, thus precluding further hoisting stress on the hook 27 and preventing the jib from further tilting and breaking or capsizing the entire crane.

As, moreover, the crane span may be varied by a traverse motion of the carriage 13, a heavier load might be lifted at y than at y' and the motion of the carriage 13 from y to y' might prove to be dangerous since the maximum load must gradually dwindle down during that motion. Here again, the safety means operate in the same way in response to a downward tilt of the jib 2 a corresponding pull on the tie rod 8, a rocking of the lever 10, a lowering of the shaft 12 and an operation of the bar 24, thereby declutching the drive at 22 and bringing the carriage 13 to a standstill ere to its reaching a critical position during its outward stroke along the jib 2.

It will be seen from the foregoing that the numerous objects of the invention are fulfilled in a crane having the aforesaid structure and that while allowing of easy supervision and manipulation of the crane, said structure precludes all accidents arising from overloads on the grapple due regard being paid to the span connoted by the position occupied by the jib carriage when said grapple begins to exert its lifting stress.

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ANTOINE FAURE.

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BY A. P. C.

A. FAURE ET AL
CRANE
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Fig. 1

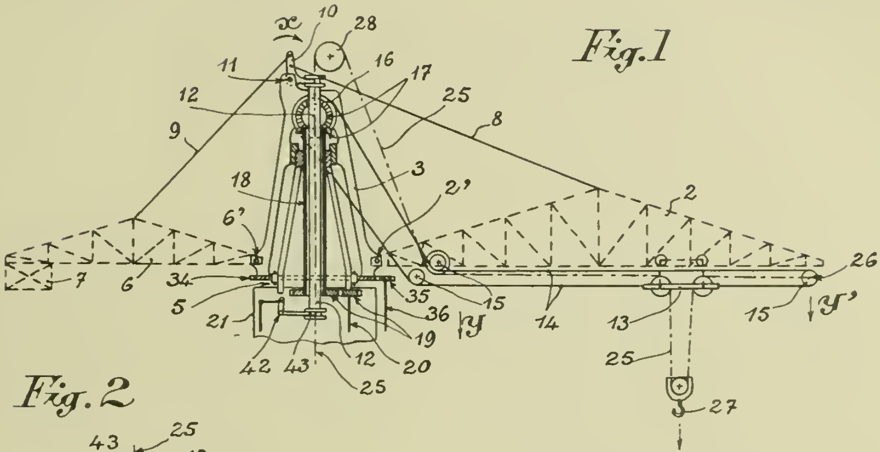


Fig. 2

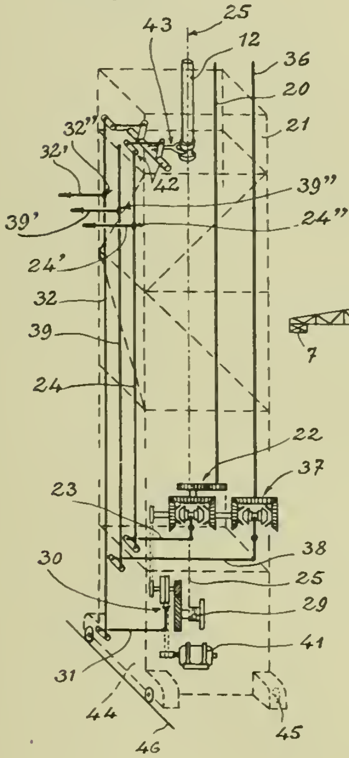
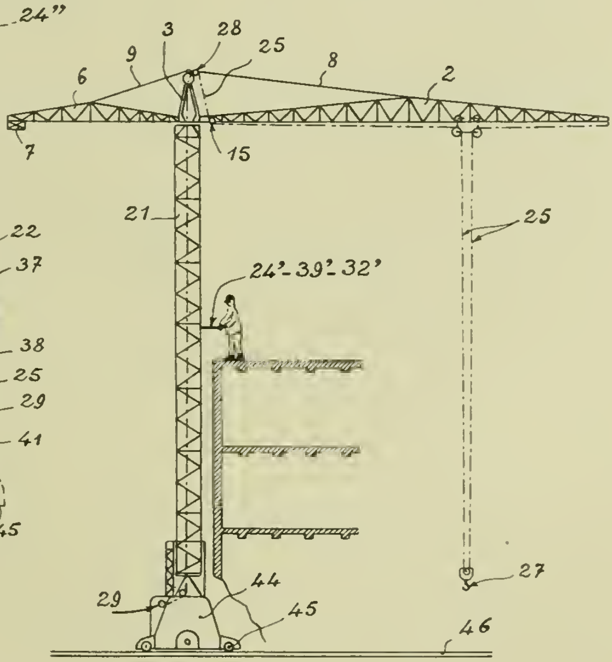


Fig. 3



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ALIEN PROPERTY CUSTODIAN

AUTOMATIC LINE CENTERING AND SHIFTING DEVICE FOR TYPE SETTING MACHINES

Fernand Charles Souche, Oullins, France; vested in the Alien Property Custodian

Application filed October 15, 1942

There exist several systems for the automatic centering of the lines in linotypes and the like type setting machines, but such systems are only adapted for use with those machines for which they have been designed. These systems are generally delicate in their handling and are easily put out of adjustment; the mechanical part, housed within the vice of the type setting machine is often locked by metal scraps from the parings formed by the line calibrating knife and moreover it is subject to the impact of any fortuitous jet of molten metal.

My invention has for its object an automatic line centering and shifting device which may be mounted without any modification on all linotypes and the like type setting machines, said device centering with the greatest accuracy the text or shifting towards the right or the left the lines of lead alloy molten by the type setting machines for printing purposes.

In my improved device, the spacing between the two jaws between which the line is cast, is controlled by a rack acting on each jaw and adapted to be displaced by means of a set of pinions driven in the required direction by another rack. Last mentioned rack is pivotally secured to the end of a connecting-rod yieldingly connected in its turn to a lever which rocks under the action of a cam keyed to the cam shaft of the linotype or the like machine.

Means are also provided for engaging at a time if required only one of the two racks which control the jaws and also for putting the device in or out of gear.

Appended drawings show, by way of example, a form of execution of my invention.

Fig. 1 is a perspective view of the whole device, designed for the case where the control is obtained through the addition of a complementary cam on the cam-shaft carrying for instance the cam actuating the first elevator of the type setting machine.

Fig. 2 is a cross-section along line 2—2 of Fig. 4, showing the inside of the mechanism-carrying casing.

Fig. 3 is a cross-section along line 3—3 of Fig. 2.

Fig. 4 is a cross-section along line 4—4 of Fig. 2.

According to my invention, the automatic centering operations are performed through the mechanical control of the vice jaws.

The right hand jaw 2 (Fig. 1) is integral with a rod 3 the end of which is provided with a rack 4.

The left hand jaw 5 (Fig. 1) is integral with another rod 6 the end of which is also provided with a rack 7.

The portions of the rods 3 and 6 which are provided with the rack teeth run through the casing 8 and are constantly in gear respectively with the pinion 9 through the rack on rod 3 and with the pinion 10 through the rack on rod 6 (Figs. 2 and 4).

The pinions 9 and 10 are loosely mounted on the corresponding shafts 11 and 12, and may be engaged respectively with the bosses 13 and 14 (Figs. 2, 3, 4) mounted on the shafts 11 and 12. These bosses 13 and 14 are provided with an inner toothwork having the same pitch as the racks 4 and 7 and adapted to engage a cooperating toothwork on the pinions 9 and 10 respectively. Said bosses are keyed to their shafts 11—12 with slight friction so as to be capable of a longitudinal sliding motion along said shafts under the action of the small levers 15—16 (Figs. 2 to 4). These small levers are pivotally secured at their lower free end to the hinge 17 and carry on their medial portion a spigot 18, 19 engaging a groove in the cam 20. This cam controlled by the handwheel 21 is adapted to cause these levers to make the system of bosses 13, 14 occupy one of the three following positions:

First position: The boss 13 has advanced towards engagement with the pinion 9 while the boss 14 has receded away from the pinion 10.

Second position: both bosses have advanced towards the corresponding pinions 9 and 10.

Third position: the boss 13 has receded away from the pinion 9 while the boss 14 has advanced towards the pinion 10.

The shafts 11 and 12 also carry the pinions 22 and 23 which are frictionally fitted over these shafts and which mesh with the vertical racks 24 and 25 (Figs. 2 to 4).

These vertical racks are carried by a support 26 (Figs. 1 to 3) which receives an upwardly directed motion from the cam 27 through the agency of the connecting rod 29 (Fig. 1) pivotally secured to the lever 28 at the stationary point 30. The cam 27 is suitably keyed to the cam-shaft carrying for instance the cam controlling the first elevator of the machine. The connecting rod 29 and lever 28 are interconnected through a yielding coupling constituted by a small connecting rod 31 (Fig. 1) and by a spring 32 wound round same and bearing on one hand against the stirrup-shaped end of the small connecting rod 31 and on the other against the bottom of the tubular member 33; said tubular mem-

ber 33 which is provided with a shoulder is fitted over the rod 31 and is itself pivotally secured to the connecting rod 29 through the spigots 34; a nut 35 screwed over the threaded upper end of the small connecting rod 31 is urged against the shoulder on member 33 so as to limit the expansion of the spring 32 and to define the inoperative position of the connecting rod 29.

A spring 36 (Fig. 1) wound round the movable support 26 is adapted to return to its inoperative starting position the whole mechanism in the casing.

Adjustable stops 37 (Fig. 1) are provided between the support 26 and each of the racks 24 and 25 so as to allow modification of the position imparted to the jaws through said racks. These stops may be constituted by screws screwed into the lower end of each rack and the head of which rests on a lateral lower projection of the support 26. A complementary screw passing through the upper part of said support 26 urges the upper end of the corresponding racks downwards and thereby the head of the screw 37 against the lower projection of the support. While lateral set screws are provided for holding the rack when it has entered the desired position, the screws or stops 37 are provided with apertures for the insertion of the tool which is to rotate them and thus make the racks slide vertically with reference to the part of support 26 extending between said racks. A member 38 (Fig. 1) or pivoting stop carried by the lower end of the support may occupy two positions at 90° one with reference to the other in one of which position it provides for the engagement and in the other for the disengagement of the rod 29 with reference to the movable support 26.

The operation of the arrangement is as follows:

I—Filling-in or shifting of short lines from the right-hand side

The operator brings the mark on the hand wheel 21 on the casing in front of the corresponding mark, say the letter D, engraved on or otherwise affixed to the casing 8 of the device. Through this operation and through the agency of the cam 20 and of the small levers 15 and 16 (Fig. 4), the boss 13 is set in operative connection with the pinion 9 while the boss 14 recedes out of operative connection from the pinion 10. As part 38 is set manually in its operative position (Fig. 1) when the elevator has brought the types between the jaws 2 and 5, the cam 27, acting on the lever 28 acts therethrough on the support 26 and causes the racks 24 and 25 to move upwardly; during this rising motion, the racks 24 and 25 produce the rotation of the shafts 11 and 12 in the direction of the arrows 39 and 40, which drives the bosses 13 and 14 in the same direction as the shafts carrying them.

As the boss 14 is disengaged with reference to the pinion 10, the latter remains stationary and consequently the left hand side jaw 5 remains in its position of rest in contact with its stop, which is in an adjustable position corresponding to a predetermined length of line.

On the contrary, the right-hand side jaw 2 is driven in the direction of the arrow 41 (Fig. 1) until the pressure it exerts on the types pushed by its movement against the stationary jaw 5 is sufficient to compress the spring 32 in the yielding connection between the members 28 and 29 and to stop any further movement of said member 29. At this moment, a system of levers carried by the jaw 5 sets free the stop arresting the forward motion of the piston projecting molten metal into the mould of the machine. This system of levers forming no part of the invention is a usual component of linotypes and needs not be described or shown.

Once the line is cast, the cam 27 sets the lever 28 free so that the rod 29 moves downwardly under the action of the spring 36 and returns the whole mechanism together with the jaw 2 to its starting position.

II—Centering

The operator brings the mark on the handwheel 21 in front of another mark, say the letter M, on the casing of the device.

For this position of the handwheel, the bosses 13 and 14 are in engagement respectively with the pinions 9 and 10. When caused to rise, the racks 24, 25 drive the corresponding pinions 9 and 10 which cause the jaws to move, the jaw 2 in the direction of the arrow 41 and the jaw 5 in the direction of the arrow 42. The two jaws move through exactly equal amounts and hold the types fast between one another in the position defined by the adjustable stops 37, until the spring 32 begins to be compressed; when the line has been stereotyped the mechanism is returned together with the jaws to starting position by the spring 36.

III—Left hand shifting of the line

The operator brings the mark on the handwheel 21 in front of a further mark, say the letter G, on the casing 8. For this position of the handwheel, the boss 13 is disconnected with reference to the pinion 9 while the boss 14 is in engagement with the pinion 10.

The right hand jaw is thus not driven by the cam-actuated system and remains against its stop, while the left hand jaw is driven in the direction of the arrow 42.

IV—Change of breadth of the line intended for setting

The operator brings the mark on the hand wheel 21 in front of the mark D on the casing. The left hand jaw is thus held out of engagement.

Supposing the half-nut locking the rod used for justifying is raised, in the usual manner by a lever pivotally secured say to the cover of the casing, the operator will then bring the mark borne by said justifying rod in front of the mark corresponding to the length of line desired on the usual scale carried in the case considered by the cover of the casing 8. The half-nut locking the justifying rod being lowered back into operative position through the agency of a spring, the operator brings the right-hand jaw against said rod in the usual manner and he then acts on the handwheel 21 to obtain the desired displacement of the jaw 2, the different points of engagement of the boss 13 corresponding to the divisions of the justifying rod of the jaws.

V—Setting the device out of gear

The operator brings if desired the mark on the handwheel 21 in front of the letter D. The left-hand jaw is thus free. For setting the device out of gear, he disengages the member 38 and the type-setting machine works thereafter as an ordinary machine.

My improved device removes the necessity of using quadrats and spacing strips for finishing short lines such as those ending paragraphs. It avoids the handling of such quadrats and spac-

ing-bands for centering purposes or for shifting the text leftwards. For type-setting an ordinary text, it does away with the use of the spacing-strips required heretofore for giving all the lines the same length.

My improved device is secured laterally with reference to the vice in the place of the usual justifying support for the vice jaws, which support is then secured to the rear of the casing of the centering device described. All the parts of my improved device are housed in a fluid-tight casing which protects them against the impact of lead scrap and accidental jets of molten metal. Said device also forms a very resistant unit mechanically incapable of disturbances in its adjustment. The change of operation between centering, shifting rightwards and shifting leftwards is performed easily without any shock through actuation of the handwheel which is automatically held in either of the three operative positions provided for the device.

A mere rotation through 90° of an easily accessible hand-actuated stop allows neutralisation of the device when it is desired to make the type-setting machine work as an ordinary machine.

By securing a cam element on to the cam controlling the arm of the hammers adjusting the length of the line, the control of my device may be obtained through said cam element acting as cam **27**.

FERNAND CHARLES SOUCHE.

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BY A. P. C.

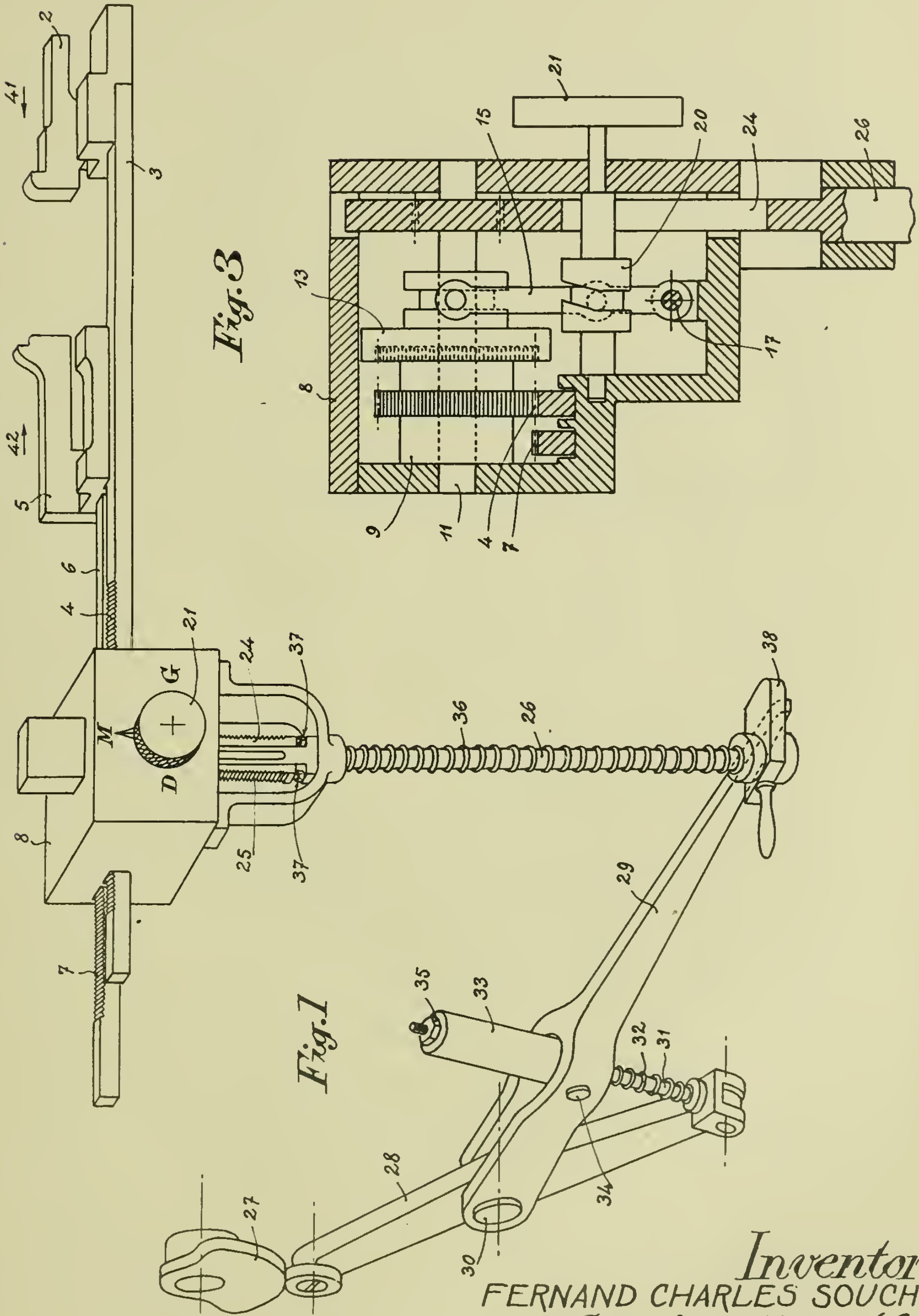
F. C. SOUCHE

AUTOMATIC LINE CENTERING AND SHIFTING DEVICE FOR TYPE SETTING MACHINES

Filed Oct. 15, 1942

Serial No. 462,098

2 Sheets–Sheet 1



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AUTOMATIC LINE CENTERING AND SHIFTING
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462,098

2 Sheets-Sheet 2

Fig. 2

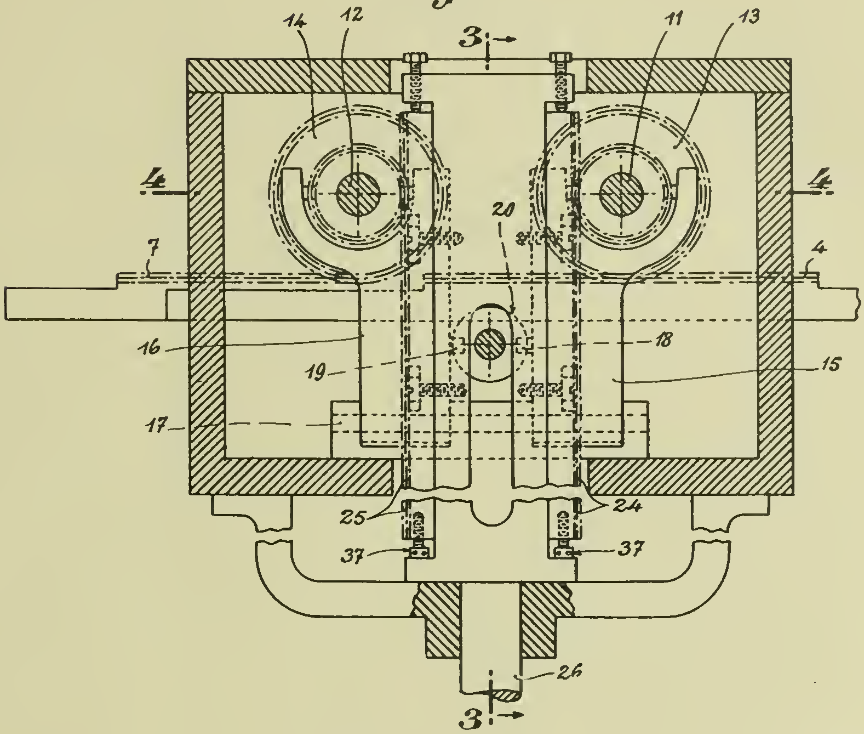
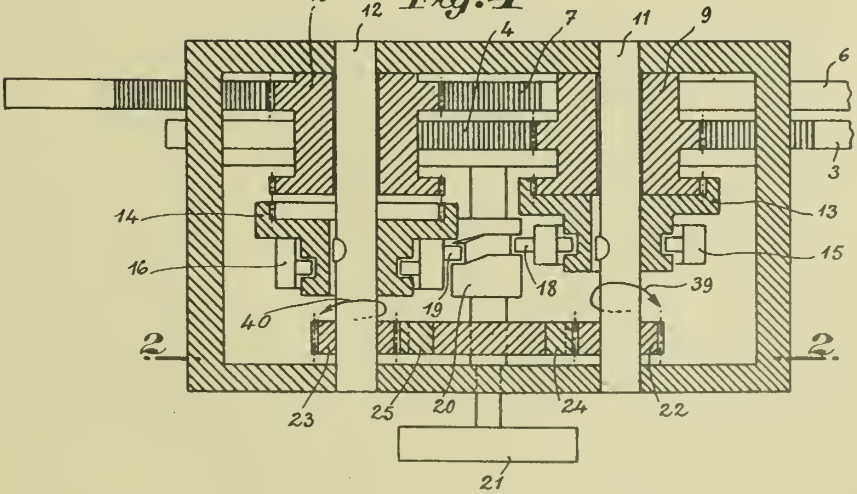


Fig. 4



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ALIEN PROPERTY CUSTODIAN

AUXILIARY DEVICES ADAPTED TO DRIVE LIGHT VEHICLES

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Application filed October 22, 1942

My invention relates to auxiliary devices adapted to drive light vehicles such as cycles and the like, and comprising an engine proper with the corresponding flywheel, a driving member for one of the vehicle wheels, such member usually acting by frictional engagement, and a number of engine accessories. These devices preferably form a driving unit pivoted about a shaft carried by the vehicle and urged against the corresponding wheel by gravity or by spring means.

One object of my invention is to provide an auxiliary driving unit of the kind above referred to, wherein the fuel tank is rigidly carried by the unit proper and practically forms a part of same.

Another object of my invention is an auxiliary driving unit of the character described, wherein the fuel tank is carried by the lower portion of the unit to lower the center of gravity thereof.

Still a further object of my invention consists in an auxiliary driving unit wherein the carburettor is disposed above the fuel tank and is fed by means of a fuel pump.

My invention also contemplates an auxiliary driving unit of the kind above referred to, wherein the fuel tank is disposed co-axially to the crankshaft and in opposed relation to the flywheel with respect to the vehicle wheel associated with the said unit.

The annexed drawing diagrammatically shows a front view of an auxiliary driving unit constructed in accordance with my invention and actuating the front wheel of a bicycle or the like.

The driving unit illustrated comprises an engine proper 1, for instance of the two-stroke type, carried by a casing or support 2 pivoted on a member 3 supported by the front fork which cooperates with the front wheel 5 of the cycle. The frame proper is shown at 4. The engine is disposed laterally of wheel 5 and the latter is driven by means of a driving roller 6 in frictional engagement with the tyre.

The fuel tank 8 is placed against the crankcase of engine 1, on the opposite side of the same with respect to wheel 5 and co-axially to the crankshaft. It is preferably cylindrical as and for the purposes explained below.

There is associated with engine 1 a flywheel 9 keyed on the engine shaft or crankshaft 10 on the other side of wheel 5 with respect to engine 1. Flywheel 9 is preferably enclosed within a casing 11 carried by a flange 12 of support 2 and comprising a removable cover 13.

It will be apparent that by disposing flywheel 9 at an appropriate distance of wheel 5 the unit may be approximately balanced with respect to roller 6. Of course, since the quantity of fuel within tank 8 varies, this balance cannot be accurate.

Tank 8 and casing 11—13 are preferably similar in shape, as illustrated, in such a manner that the unit appears as a symmetrical assembly.

The engine carburettor 14 is preferably disposed above tank 8 directly against the engine cylinder, as usual. It is of the overflow type and is fed from a fuel conduit 15 by a fuel pump 16, of the membran type, actuated by pressure variations within the engine crankcase, such pressure variations being transmitted by a pipe 17. And there is also provided an overflow pipe 18 returning to tank 8 the surplus of fuel from carburettor 14.

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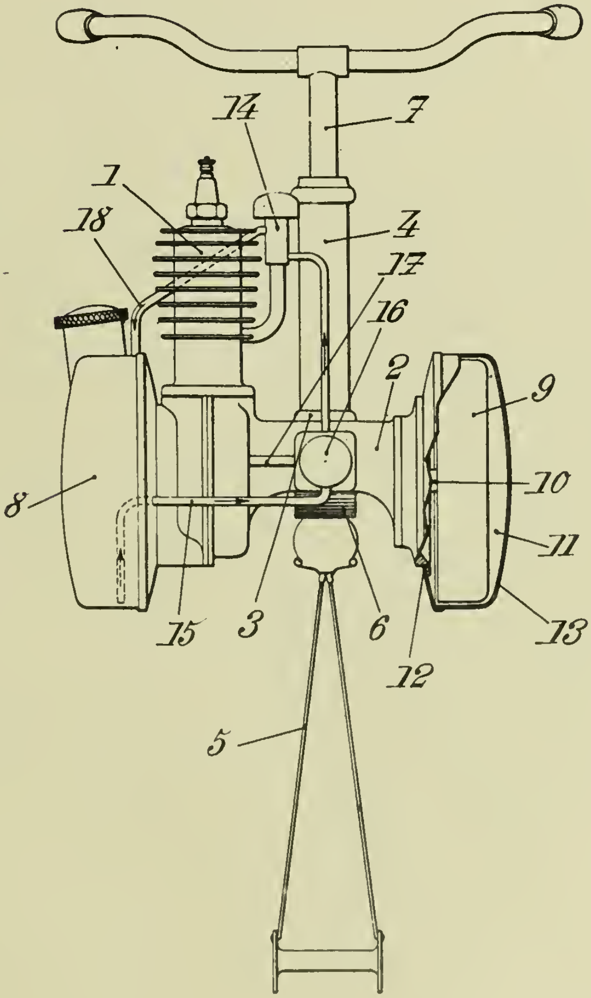

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ALIEN PROPERTY CUSTODIAN

BLOWING GAS SELF GENERATING BREAKERS

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Application filed October 24, 1942

The invention relates to a breaker in which the arc is blown at the same time on the fixed electrode by means of blowing gases produced either by the arc acting on the walls of an insulating tube closely surrounding the movable electrode in the "engaged" position, or by the action of air compression caused by the arc-heat in a closed space adjacent to the fixed electrode above the insulated tube mentioned above, and on the movable electrode by a pneumatic blowing process which produces the compressed fluid by using a piston shifting in a cylinder, driven by the motion of the movable electrode.

In such apparatus which have been realized up to now, the movable electrode, generally hollow is used as a conduct for the blowing gases and it is provided with a nozzle, some valves or slides being designed in order that the pneumatic blowing might only occur some time after the electrode has left the insulating tube surrounding it in its "engaged" position.

In order to obtain a thorough pneumatic blowing, a rather large-sized nozzle should be designed. But, the inside diameter of the movable electrode used as an air-conduct must be about twice the diameter of the neck of the nozzle, in order to avoid the excessive drops of pressure, and the inside diameter of the insulating tube into which the movable electrode penetrates must be larger still, whilst the production of a high and efficacious blowing-gas self-generating process pressure necessitates, on the contrary, an insulating tube with a small diameter (appreciably equal to the diameter of the nozzle in order to obtain the best blowing conditions). This incompability is removed by a realization carried out according to the invention characterized by the use of a solid cylindrical movable electrode shifting through a blowing-nozzle in a fixed chamber supplied with the blowing fluid compressed by the piston, driven by the motion of the movable electrode.

The annexed drawing shows several realizations carried out according to the invention.

In the drawing:

Fig. 1 shows a breaker with self-blowing of the arc on the fixed electrode and with pneumatic blowing in the opposite direction on the movable electrode.

Fig. 2 shows a breaker of the same type as that of Fig. 1, but realized in such a way as to make the movable part much lighter.

Fig. 3 shows a process that delays the action of the pneumatic blowing.

Fig. 4 shows a similar process realized in another way.

Fig. 5 shows some improvement in the blowing-nozzle of the movable electrode.

Fig. 6 shows in cross-section, and Fig. 7 in front-section, an advantageous disposition of the expansion-chambers of self-generated blowing gases for contact breakers provided with disconnecting electrodes disposed in parallel with the cutting-off electrode.

In Fig. 1, **1** represents the fixed electrode, **2** an insulating chamber closely surrounding the movable electrode in the "engaged" position, and, in the particular case of this realization, also the fixed electrode **1**, **3** the movable electrode constituted by a rod controlled by a steering-gear including the lever **4**. The current is transmitted to the movable electrode by a system of contact-fingers **5**. A piston **6** is fixed upon the electrode **3** by means of a sleeve **7** fixed on the movable electrode by stays **7'** allowing the air compressed by piston **6** in a cylinder **6'** co-axial with the electrode, to penetrate into a tube **8** in which the sleeve **7** slides. This tube **8**, used as a nozzle, is provided, at its end, with a blowing-nozzle **9**. Apertures **10** are made in the bottom of the cylinder **6'** and prevent the compression or depression on the back face of the piston **6**. In order to delay the action of compression and to lessen the working of the piston, apertures **11** are made in the cylinder **6'** in such positions necessary to produce the wanted delay.

The cutting-off of high intensities is carried out when the electrode-rod **3** gets out from the extremity of the insulating tube **2**, and the cutting off of low and mean currents, on the first passage of the intensity to **0**, following the coming of the rod **3**—end above the neck of the blowing-nozzle **9**, which is fixed up so that the end of the movable electrode in the "disengaged" position is in the part of the neck of the nozzle where it is subject to the highest blowing.

The quantity of air wasted before the coming of the electrode to the breaking-position is reduced to a minimum because of the slight play existing between the electrode **3** and the nozzle **9**. In order to avoid the loss of air, the compression may also take place only after a certain run of the movable electrode by using, for instance, the above mentioned apertures **11**.

Fig. 2 represents a realization, similar to that of Fig. 1, but in which it has been endeavoured to make the movable part the lightest possible.

In this figure, the fixed electrode **1** is still surrounded with the insulating tube **2**, the movable electrode **3** passes through a blowing-chamber **8** provided with a blowing-nozzle **9**. The current is transmitted to the movable electrode by a sys-

ten of contact-fingers 5. A controlling steering-gear includes a lever 4. At the same time, the lever 4 operates the piston of a compressor 6, which supplies, by means of a conduct 12 adjusted in the insulating-support, the chamber 8 with blowing fluid.

This process allows to shorten the rod which constitutes the electrode 3; the result is a diminution of the length and space occupied of the outfit, a diminution of the drops in voltage in the rod and at the same time a diminution of the weight of the latter.

In order to delay the action of the piston 8 and of the blowing, apertures 11 may also be designed in the cylinder of the compressor, or even another disposition, such as the one represented in Fig. 3, in which the operating-lever 4 is provided with an axis 13 sliding in a button-hole 14 arranged on the push-rod of the piston 6, the axis 13 being elastically bound by a spring 15 to a fixed thrust-block 16 of the push-rod of the piston. At the beginning of the disengaging motion, the lever 4 compresses the spring without appreciably driving the piston 6 submitted to the increase of pressure of the fluid in the cylinder. This lack of connection between the lever 4 and the piston 6 allows the lever 4 and the electrode 3 to be quickly set to full speed.

The same kind of result may be obtained by using, as a lever 4 linked to the push-rod of the piston, a cranked lever represented in Fig. 4, and the angle of which is such as, to an important longitudinal shifting of the extremity A connected to the electrode, should correspond a longitudinal shifting, first relatively small and afterwards more important, of the extremity B setting the piston in motion.

In the device of Figs. 1 and 2, the cylinder of the compressor constitutes a damper for the cutting-off of high currents which is made at full speed. In the cutting-off of low and mean currents, the strain on the movable rod, due to the pressure of the self-generated blowing-gas device, is added to the strain of the switch driving organ to raise the pressure of the pneumatic blowing.

In order to avoid the metallic projections or carbonized deposits on the leakage-line of the nozzle, we may adopt a nozzle with cylindrical external outlines protecting, by its cross-section (c—c'), the leakage-line (c—d, c'—d'), as it is shown on Figs. 1 and 2. In order to improve the protection of this leakage-line, the nozzle may be provided, as it is shown in Fig. 5, with a protecting the leakage-line (c—d—e,$c'd'e'$) against the projections blown out from the aperture of the insulating tube 2.

Of course, though the self-generated blowing gas device of the fixed electrode, schematically described and represented, works thanks to blowing-gases generated on the walls of the insulating tube closely surrounding the movable electrode in its "engaged" position, the invention applies also, since it presents the same advantage when the self-generated blowing gas device is realized in such a way that a closed space is adjacent to the fixed electrode above the insulating tube either or not emitting gases under the effect of the electric arc and closely surrounding the movable electrode in its "engaged" position. Whatever principle is used for the generation of the blowing gases, it is advantageous to have the extremity of the blowing-tube come out into a chamber of large size with regard to that of the tube, and in which the gases expand and grow cold before being evacuated outside.

Figs. 6 and 7 show a specially interesting realization of this expansion chamber in the case when the high power switch, the cutting-off electrode section of which is too small to stand the nominal current continually, has to be shunted by a disconnecting switch which presents itself in the shape of a second electrode parallel with the cutting-off electrode of the disconnecting switch.

The large size given to the chamber in which the arc-gases expand, considerably interfere with a rational disposition of the electrode constituting the disconnecting switch in relation to the cutting-off electrode.

A disposition already used consists in having the electrode constituting the disconnecting switch pass in the chamber used for the gas-expansion, and designing an electric and mechanical separation of the passage of the electrode constituting the disconnecting switch with regard to the inside of the chamber.

This realization presents a few difficulties of construction and also has the disadvantage of withdrawing the disconnecting electrode from ventilation on part of its length.

A realization made according to the invention eliminates these disadvantages and, on the contrary, presents some particular advantages; it consists in adjusting, in the chamber where the gas-expansion is carried out, a conduct the section of which is that of a U and in which the electrode constituting the disconnecting switch passes.

In the realization of figs. 6 and 7, the enclosure 18, in which the gas expand before it is rejected outside, includes a channel 19 in the shape of a U in which the disconnecting electrode 20 passes, while the cutting-off electrode 3 passes in the inside of the insulating tube 21 surrounded with the chamber 18. The cutting-off of the disconnecting electrode precedes that of the cutting-off electrode, its engaging following that of the cutting-off electrode.

The special shape of the channel allows a good ventilation of the electrode 20 and at the same time the particular shape of the chamber resulting from the presence of the channel 2 contributes to a better guiding for the evacuation of the cutting-gases.

Of course, instead of making one channel only in the chamber where the gas expansion is carried out, we may make several of them, in which several disconnecting electrodes disposed in parallel with the cuttting-off electrode, will pass.

Independently of the advantages of working, already mentioned, in improved conditions of cutting-off resulting from the use of a movable electrode, and consequently of an insulating tube closely surrounding it in the "engaged" position, of a small diameter, and of a fixed blowing air-conduct the diameter of which is independent of that of the insulating tube. this device presents numerous advantages still in relation to the similar devices known up to now. Indeed the very slight play between the electrode-rod and the nozzle allows to carry out the pneumatic blowing only at the best moment and in a definite geometrical position, independent from the cut off intensity, when the extremity of the electrode-rod comes above the neck of the nozzle, whereas the working of a gas-operated valve is uncertain.

The fixity of the blowing-organ. nozzle and air-conduct reduces the weight, thence the inertia of the movable part, specially with the disposi-

tion of fig. 2 and allows to obtain greater speeds of engaging and disengaging.

For an equal nominal intensity, the diameter of the blowing electrode-tube being superior to the diameter of a rod realized according to the invention, in the known devices, the acceleration imparted to the movable part by the pressure of the arc-gases or of the air compressed by the arc-heat in the chamber adjacent to the fixed electrode above the insulating tube closely surrounding the movable electrode in its "engaged" position, will be greater and the kinetic energy, that is to be damped down, will also be greater than in the devices carried out according to the invention.

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BLOWING GAS SELF GENERATING BREAKERS

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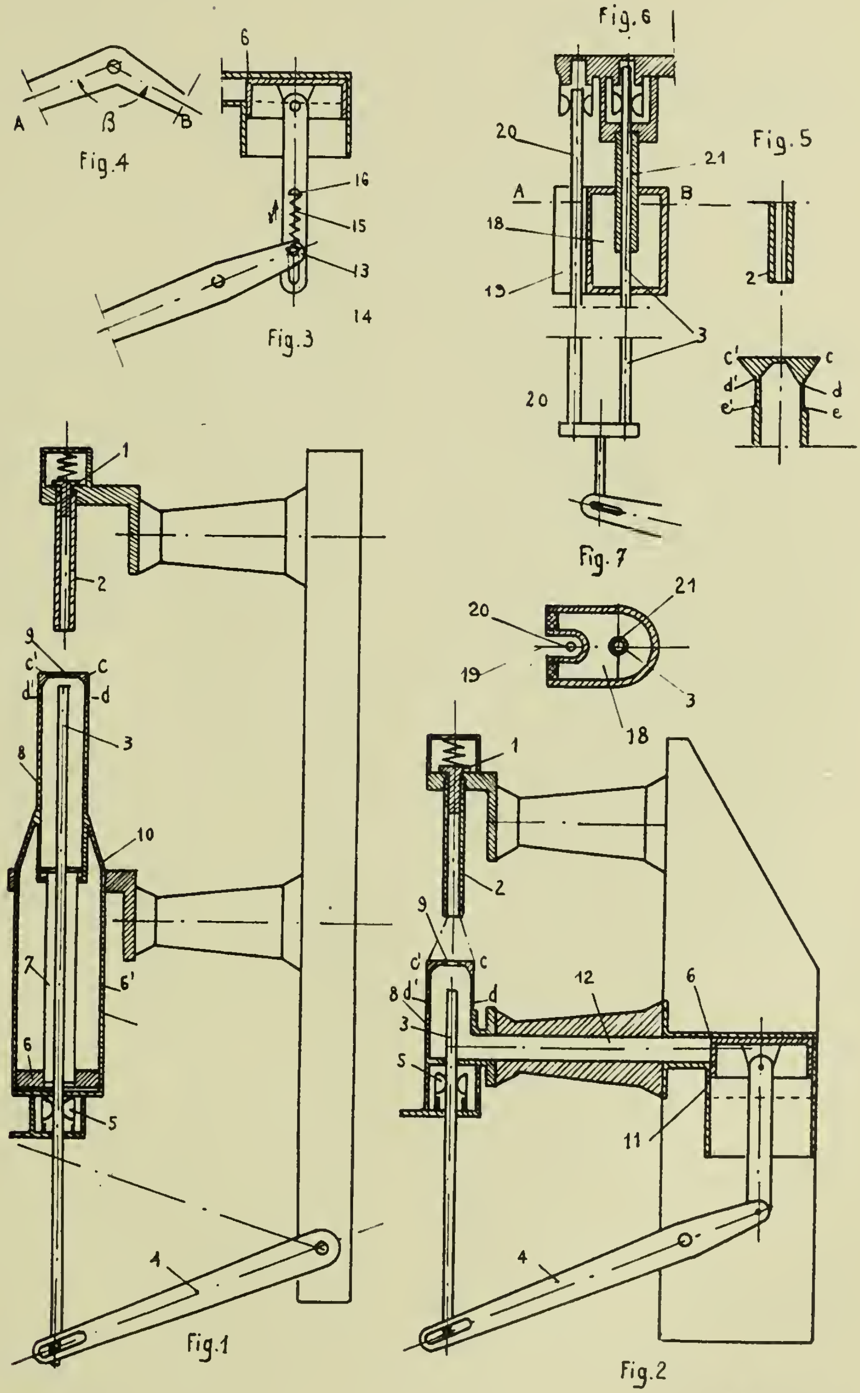

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ALIEN PROPERTY CUSTODIAN

FEED CONTROLLER FOR RECORD ENGRAVER CARRYING CARRIAGE

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Application filed October 27, 1942

This invention relates to an improved feed controller for record engraver-carrying carriages adapted to fulfil the requirements laid down for the mechanical registration of sound tracks on records and to satisfy the most up-to-date needs so far as automatism and safety factors are concerned in modern record broadcasting technique.

It may be recalled that for practical broadcasting purposes, a machine should be adapted to receive records having a diameter equal to forty centimeters and should revolve at speeds of 78 and 33⅓ R. P. M. Moreover, several different pitches on the spiral furrow must be utilisable depending upon the length of the record and the characteristics of the material of which it is made. As furthermore common recordings must often exceed the registration capacity of one face of the record and all emitting stations now use the so-called differential system for record reading, means must be provided to enable an index furrow spaced from the other furrows to be produced during registration. Such index furrow is obtained by momentarily increasing the tool carriage feed and is generally called synchronization furrow. As the registration draws to its close, the last furrow should be moved off previous furrows and should be closed up so that while the pick up device continues to be guided, it cannot sweep the center of the record and produce an undue rattle.

Registering machines have already been proposed to enable these manipulations to be effected manually but they obviously call for special skill on the part of the operator who must therefore have been trained therefor during a considerable time. Moreover, no matter how skillful the operator may be, accuracy of movements is limited down by precision in human reflexes and the latter can be modified by the physical condition of the operator. Apart from that, as synchronization must be properly indexed on both operating machines, the latter must be simultaneously accessible to the operator, thereby considerably curtailing the possible arrangements of the appliances in a registering studio.

An object of the present invention is to provide a new or improved feed controller for record engraver-carrying carriages used in sound track registering machines obviating the foregoing disadvantages and furnishing all freedom for the selection of sites or locations ascribed to the machines.

Another object of the invention is to provide an improved controller as aforesaid wherein the means ensuring the feeding or traversing motion of the record engraver-carrying carriage is actuated through a pair of free wheel devices operated in turn from the record carrier drive, one of said devices being associated with a primary gear such advantageously as a change speed gear while the other device is associated with a secondary gear adapted for a quicker feed and capable of being temporarily set into rotation selectively through a clutch, the operation of said clutch being controllable from a distance to suit requirements throughout the recording process.

A further object of the invention is to provide an improved controller as aforesaid wherein the whole cycle of motions required for the formation of an index or synchronization furrow as well as the motion required for closing up the furrow at the end of the record are automatically controlled, thereby obviating any manual handling which would require special skill and any risk of a record being damaged by unclever manipulation on the part of a clumsy operator.

A still further object of the invention is to provide an improved controller as aforesaid incorporating safety means so that where the operator inadvertently forgets to switch off the motor when the sound track or furrow reaches the central region of the record being registered, the carriage feeder holding solenoid is automatically switched off and the engraver is brought to inoperative position.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel construction, combination and arrangement of parts that will now be described with reference to the accompanying diagrammatic drawings showing a convenient embodiment of the same and forming a part of the present disclosure.

In the drawings:

Figure 1 is a fragmentary sectional line on the zigzag line I—I of Fig. 2 showing the change speed gear and the actuating means for the carriage feed controller.

Figure 2 is a sectional view on the line II—II of Fig. 1.

Figure 3 is a sectional view on the line III—III of Fig. 1.

Fig. 4 is a sectional view on the line IV—IV of Fig. 6.

Fig. 5 is a sectional view on the line V—V of Fig. 6.

Figure 6 is a fragmentary sectional view on the zigzag line VI—VI of Fig. 4.

Figure 7 is a fragmentary sectional view on the line VII—VII of Fig. 4.

Figure 8 is a wiring diagram showing the electrical connections for the clutch actuator.

Figure 9 is a top plan view of the entire apparatus, assuming certain parts to be broken away for the sake of clearness.

Figure 10 is a fragmentary sectional view on the line X—X of Fig. 9.

Like reference characters designate like parts throughout the several views.

As illustrated in Fig. 9, a motor **100** is secured to the casing **101** of a train of gears **102**, **103**, **104**, **105** adapted to transmit the impulse from said motor to a toothed wheel **106** fast on a shaft **107** supporting a record-carrying platform **108**. Constructional details of the drive are fully set forth in a co-pending application and will not on that ground be described in detail in the present specification.

The record-carrying platform **108** actuates a worm **109** secured to the axis **110** of the gear **105**.

An annular worm wheel **111** meshing with said worm communicates the motion of the platform **108** to a change speed gear through a flexible shaft **112** having its end fixed to a stub shaft **1**. The transmission ratio is so reckoned as to cause the shaft **1** to revolve at the same angular speed as the platform **108**. The shaft **1** has rigidly secured thereto a pinion **2** meshing with a spur wheel **3** rigidly fixed to a spindle **4** which is hollow over a portion of its length to accommodate a plunger **5** carrying a transmitting finger **6**. The axial movements of said plunger are derived from an annular worm wheel **7** meshing with a worm **8** rigidly carried by the plunger **5**. The worm wheel **7** is fast upon a shaft **9** fitted with a manually operated pitch-varying hand wheel 9^a (Fig. 9). The transmitting finger **6** projects sidewise from the tubular spindle **4** through a port **10** therein. Opposite said port are provided for idle rotation four pinions **11**, **12**, **13**, **14** respectively formed with grooves **15**, **16**, **17**, **18** adapted selectively to receive the upper portion of the transmitting finger **6** which projects through the port **10**. Each of the pinions **11**, **12**, **13**, **14** forming the "primary gear" meshes with one of four spur wheels **19**, **20**, **21**, **22** loosely mounted for idle rotation on a spindle **23** and interconnected by countersunk dowels. The four spur wheels **19**, **20**, **21**, **22** drive the shaft **23** through a cushioning unit comprising dowels **24** tightly fitted in plastic material blocks **25** housed in corresponding recesses in the spur wheel **19**. Such dowels engage into a free wheel ring **26** which drives the shaft **23** through wedging feathers **27** and a bushing **28** fast upon said shaft. Such feathers enable the shaft **23** to be driven by the free wheel ring **26** while preventing the same from being driven by the shaft **23**.

As shown in Figs. 1 and 2, the end of the shaft **1** has keyed thereto a pinion **30** meshing with a companion pinion **31** fast upon a pin **32** which, through a magnetic clutch, drives a spur wheel **34** meshing with a pinion **35** and a gear **36**. This gear **36** (hereafter called the "secondary gear") is loosely mounted on an intermediate shaft, while the pinion **35** loosely mounted on the shaft **23** drives the latter through cushioning means comprising dowels **37** having a tight fit in plastic material blocks housed in recesses in the pinion **35**. Such dowels **37** are in engagement with a free wheel ring **38**. The drive of the shaft **23** takes place owing to the wedging effect of feathers **39** on the bushing **28** rigid upon said shaft **23**. Such feathers **39** are so arranged that the pinion **35** can drive the shaft **23** when both elements of the clutch **33** are in inter-engagement and that, conversely, the pinion **35** cannot be driven by the shaft **23**.

As shown in Fig. 6, the above-stated magnetic clutch is made up of two parts, one of which (**40**) is rigid with the spur wheel **34**, while the other one (**33**) is rigid with the pin **32** operated by the stub shaft **1**. An electromagnet having its winding **42** coiled around the pin **32** controls its axial movements. Said winding **42** is fed by an auxiliary source of electricity (not shown) and has one of its terminals earthed and its other terminal connected to a contact blade **44** bearing against the end of the pin **32**.

The driving device for controlling the feed of the carriage **118** and the movements of the sound track engraver **117** comprises the following elements:

1°—Electric switches H, I, K, L, M (Fig. 7) mutually interconnected electrically speaking and fitted on a common shaft operatively connected to the movable element **33** of the clutch and consequently to the carriage feeding worm.

2°—A relay A of the telephone type.

3°—A pair of relays B, C of the telephone type having wiper contacts.

4°—Control switches S, F, G, V, R.

5°—A pair of electromagnets E, D adapted to respectively hold in operative position a nut **115** engaging a feed worm **116** which controls the motions of the carriage **118** and an engraver **117**; the latter is described in detail in a co-pending application.

6°—A limit switch P for the carriage.

7°—A pair of safety switches U, T.

8°—An auxiliary source of electric current (not shown) tapped at n and m (Fig. 8).

As shown, the relay A has a winding a and a twin blade reversing switch **45**, **46** whose blades respectively come into contact either with contacts **50**, **49** or else with contacts **48**, **47** depending upon whether the winding is energized or deenergized.

Likewise, the relay B has a winding b and a reversing switch comprising three blades **51**, **52**, **53** which respectively come into contact either with contacts **58**, **57**, **59** or else with contacts **55**, **54**, **56** depending upon whether the winding b of the relay is energized or deenergized.

Likewise again, the relay C has a pair of windings c^1, c^2 and a reversing switch including a pair of blades **60**, **61** which respectively come into contact either with contacts **62**, **63** or else with contacts **64**, **65** depending upon whether the windings are energized or deenergized.

The revoluble switches are each constituted by a wiper contact **76**, **77**, **78**, **79**, **80** and a cam **66**, **67**, **68**, **69**, **70** made of an insulating material covered over a portion of its periphery by a metal blade **71**, **72**, **73**, **74**, **75**. All metal blades **71** to **75** inclusive are electrically connected by the wiper contact **80** and the blade **75** to one pole (n) of an auxiliary source of electricity (not shown).

The switch U is a two position single switch. It comprises a blade **81** electrically connected to the electromagnet D, and a contact stud **82** electrically connected to said auxiliary source by being properly earthed.

The switch T is a two position two pole switch. It comprises a pair of blades **83**, **84** and a pair of contacts **85**, **86**. Said switch T is controlled by the double electromagnet E which simultaneously actuates the nut **115** through the medium of a lever **119** pivoted at **120** upon the adjacent part of the carriage and subjected to the action of a

spring 121 which tends to remove the nut 115 from the worm 116. The nut 115 controls the feed of the carriage 118 to which the engraver 117 is secured. To that effect, the nut 118 projects through a port 122 in the carriage, and the latter is slidably received in a groove 123 formed in the machine frame. It will be seen that the nut 115 is removed from the worm 116 by the spring 121 as soon as the electromagnet E ceases to be energized, said spring simultaneously opening the switch T.

The switch U is controlled in a similar way.

It is a matter of course that the electromagnets E, D might be superseded by similarly acting mechanical means.

As will be understood from the foregoing, both switches T, U are manually closed while they are automatically opened by means of an electrically or mechanically operating device when the electromagnets D, E are respectively deenergized.

The control switches S, F, R, V, C comprise press buttons among which those referenced by S, F and R are for closing purposes while those referenced by V, G are for opening purposes.

The operation of the entire device takes place as follows and will be set forth under successive headings:

Starting of device

The motor 100 which is adapted to actuate the record-carrying platform 108 is first switched on. Then shortly before the outset of the sound track registration, the safety switch T is manually closed. This energizes the double electromagnet E (through n, 51, V, P, 83, 85 and m) and enables the nut 115 on the carriage 118 to be brought into engagement with the feed worm 116. As the registration begins, the safety switch U is closed and the engraver 117 is laid upon the record (not shown) carried by the platform 108. As the electromagnet D is then energized through n, T, 86, 90, G, 81, 82 and m, it holds down the engraver 117 in operative position, whereupon the registration of the sound track takes place normally as set forth in a co-pending application.

It will be seen that owing to the provision of the safety switches T, U, it is quite impossible to perform an unskillful manipulation when starting a sound track registration and to scratch or otherwise hurt the record. Thus for example the engraver cannot be laid upon the record if the carriage nut is not in engagement with the worm.

Generation of a synchronization furrow

When the operator wants a synchronization furrow to be produced, it is only sufficient for him to operate the press button S to close the circuit. The closure of the circuit energizes the winding 42 of the magnetic clutch 33 (through n, S, 45, 48, 54, 52, 44 and m) whose elements are thus interwedged. From now on, the stub shaft 1 drives the shaft 23 through the pinions 30, 31, the spur wheels 34, 35, the elastic coupling 35, 37, the free wheel ring 38 and the feathers 39 which then come into wedging relation with the bushing 28 which, as aforesaid, is rigid with the shaft 23. These pinions and spur wheels are so provided that the shaft 23 should revolve about four times faster than when it is actuated by the pinions 11, 12, 13, 14. As a result of this, the engraver-carrying carriage is also fed four times faster and the resultant furrow or sound track also has a higher pitch.

As the spur wheel 34 meshes with the gear 36, the revoluble switches H, I, K, L, M are rotatably driven. The pinions 31, 30, 34, 36 are so selected as to cause the rotary speed of the switches to be equal to that of the record-carrying platform 108, whereby to one full revolution of said platform corresponds a full revolution of the switches H, I, K, L, M.

Shortly after the beginning of this rotary motion, the wiper contact 78 of the switch K rides over the cam blade 73. As said blade is connected to the source of electrical current via the switch K and as the wiper contact 78 is connected to the contact 54, the switch shunts the press button S. This results in the magnetic clutch remaining engaged even if the operator releases the button S. Then as the rotation of the switches continues, the wiper contact 79 of the switch I rides over the cam blade 74. The latter is connected to the source of current through the switch H, while the wiper contact 79 is connected to one end of the winding a of the relay A whose other end is directly connected to said source by proper earthing. Therefore the relay A is energized and actuates the two pole switch 45, 46. From that moment on, the press button S is connected via the blade 45 to the contact 50 which is connected to the wiper contact 79 and is accordingly switched off. Consequently the clutch remains energized until the switches resume their inoperative position. This takes place after a full revolution of the latter. In fact, after a full revolution of the switches K, I, the wiper contacts 78, 79 respectively move off their cam blade 73, 74 so that the relay A is deenergized as well as the winding 42 of the magnetic clutch. At that moment, the whole device comes to a standstill in the original position, the clutch being disengaged and the shaft 23 is again operated through the pinions 11, 12, 13, 14 forming the primary or change speed gear. As the switches H, J, K, L, M revolve at the same speed as the record-carrying platform 108, it will be found that the engraver has cut only one synchronization furrow of higher pitch.

Where it is desired to produce two synchronization furrows one after the other, it is only sufficient to press the button R shortly after reaching the end of the first furrow and to hold it in this position during a fraction of revolution of the platform, i. e. during a short period of time just sufficient to enable the wiper contact 78 to again come into engagement with the metal blade 73.

End of record registration

The end of the record registration is controlled by operating the press button F to close the circuit. When pressing upon the button F, the winding b of the relay B and the winding c^1 of the relay C which are connected in parallel are energized through the blade 46 and the contact 47 of the relay A. The relay B is then "stuck" and operates the three pole reversing switch 51, 52, 53 while the relay C operates the two pole reversing switch 60, 61. Consequently the wiper contact 77 of the revoluble switch L is connected to the contact 47 via the contacts 59 and 53. As said wiper 77 is in contact with the cam blade 72 and as this blade is connected with the source of current, through the switch K, the press button F is shunted by the switch L. Therefore the operator can release the button F without any risk. Moreover, the blade 52 is now in contact with the contact 57 so that the winding 42 of the clutch is directly fed. The clutch being operative, an increased pitch furrow is cut in the record, as above stated, while the switches are set into revolution. Furthermore, the carriage nut holding

electromagnet E which was fed via 55, 51, V and P is now fed via H. 71, 76, 58, 51, V and P but as the relay B has a wiping contact no interruption of current takes place at E. As the relay C is now "stuck," the winding c^1 is fed through the contacts 61 and 65 while the engraver holding electromagnet D which was fed through the contacts 60 and 62 is now fed through the contact 60.

It will be noticed that as the relays B and C belong to the wiper contact type, all the reverses occur without break in current feed so that the electromagnets E and D constantly remain energized. Consequently the engraver remains applied on the record and the carriage continues its motion.

After slightly less than a revolution of the switches, the wiper contact 76 moves off the cam blade 71 so that the switch M cuts off the current feed to the electromagnet E. Under the influence of the spring 121, the carriage nut is then disengaged from the worm and opens the safety switch T. The engraver carriage is thus brought to a standstill and henceforward the engraver cuts a circumference into the record. The wiper contact 77 of the switch L moves off the cam blade 72 and cuts off the winding *b* of the relay B. The three pole reversing switch then resumes its original position but the winding 42 of the magnetic clutch is still fed through the wiper contact 78 and the cam blade 73 which at that time are already in mutual contact. However, the current feed to the winding c^1 of the relay C is cut off but the relay C remains "stuck" since its winding c^2 is connected in parallel upon the clutch winding 42 beyond the switch K.

After a second full revolution of the switches, the wiper contact 78 moves off the cam blade 73 and cuts off the current from the clutch winding 42 and also from the electromagnct D connected in parallel thereto. The whole switch assembly H, I, K, L, M is arrested in the original position, and as the electromagnet D is no longer energized it allows a lifting back motion of the engraver under the influence of its return spring (not shown) and thus opens the safety switch U. A closed furrow is then defined and the engraver is lifted off.

It will be seen that the whole cycle of motions which is necessary for the formation or cutting of a synchronization furrow and of a record end furrow is automatically controlled. Therefore there is no need to exercise any manual skill or special tricks to bring about such motions while any risk of a record being detrimentally affected by lack of skill on the part of the operator is precluded. Furthermore, the two machines which require to be synchronized may not be simultaneously located within easy reach of the operator.

Where, moreover, the operator forgets to perform control for the record end, it will be seen that as soon as the carriage reaches the center of the record it causes the switch P to be opened. Said switch cuts off the current which was feeding the electromagnet E that held the carriage nut so that the carriage is brought to a standstill. Disengagement of the carriage nut opens the safety switch T which cuts off the electromagnet D which so far held the engraver. The latter is then lifted and opens the safety switch U.

Where this is required, the press button G permits the engraver to be lifted off the record in the course of a sound track registering process without requiring stoppage of the carriage while the press button V connected in series with the switch P permits the carriage feed to be stopped and the engraver to be lifted off the record at each desired moment.

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PUBLISHED

JUNE 8, 1943.

BY A. P. C.

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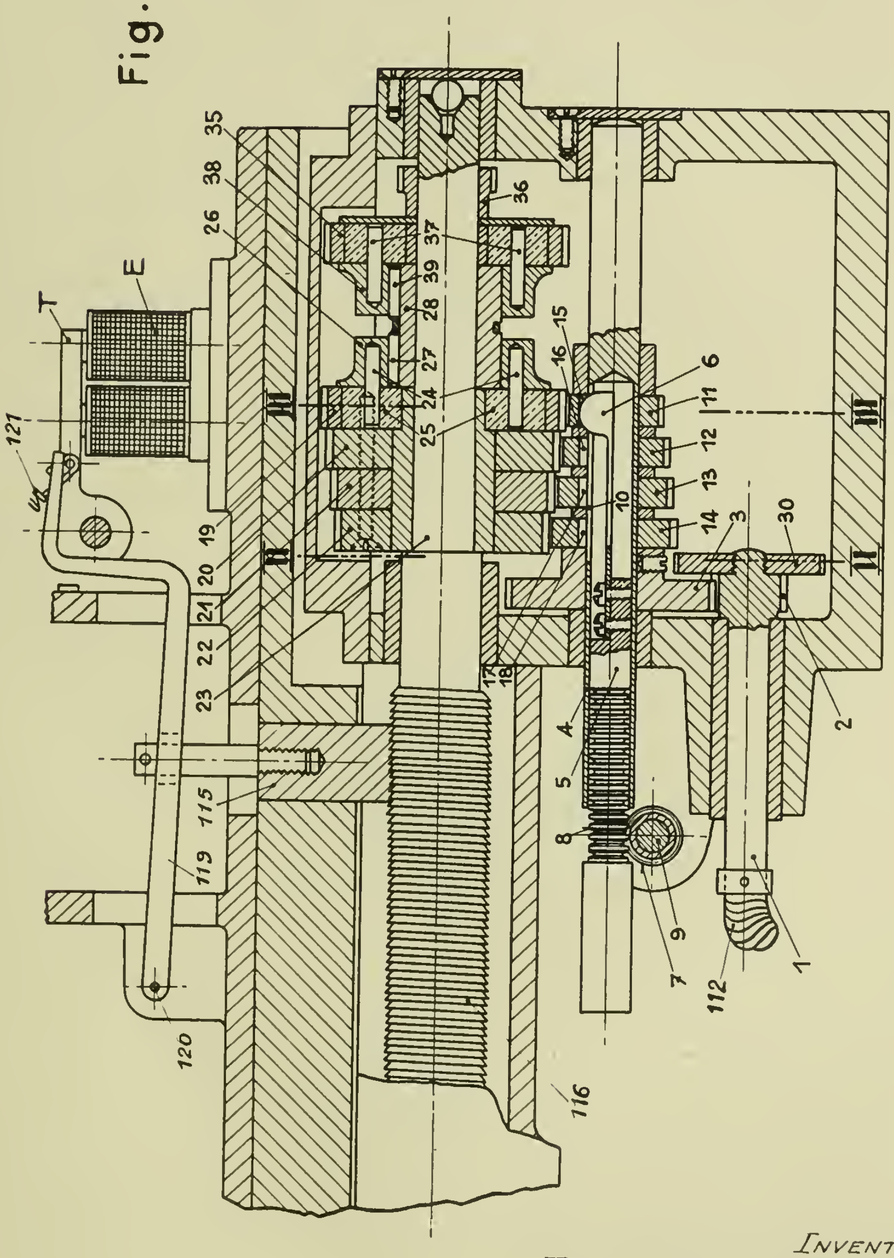
FEED CONTROLLER FOR RECORD ENGRAVER
CARRYING CARRIAGE
Filed Oct. 27, 1942

Serial No.
463,571

5 Sheets—Sheet 1

Fig. 1



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FEED CONTROLLER FOR RECORD ENGRAVER CARRYING CARRIAGE

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Serial No. 463,571

5 Sheets-Sheet 2

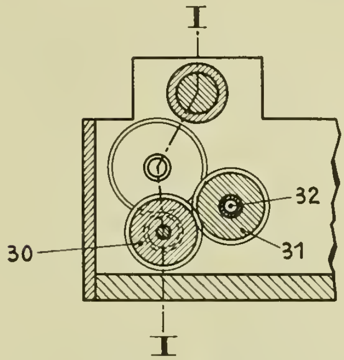

Fig. 2

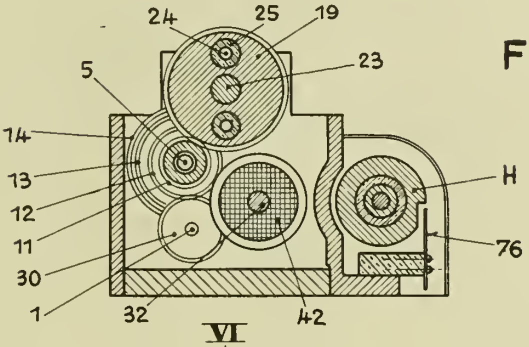

Fig. 3

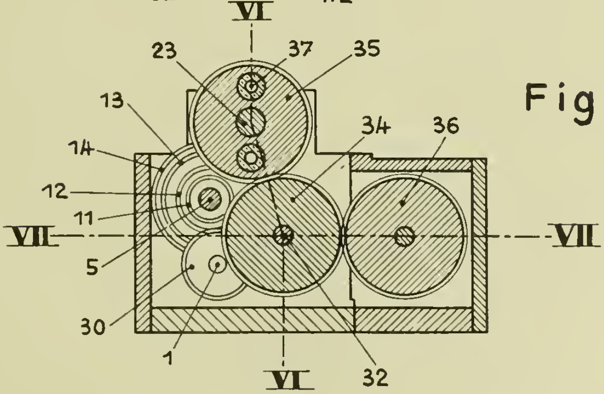

Fig. 4

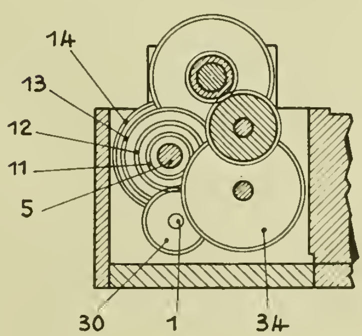

Fig. 5

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Serial No. 463,571

5 Sheets-Sheet 3

Fig. 6

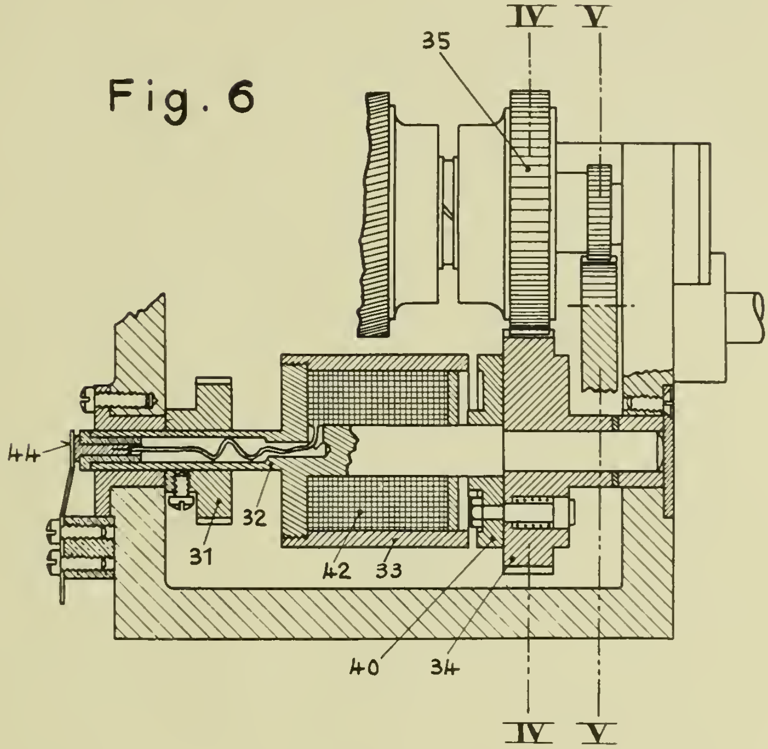
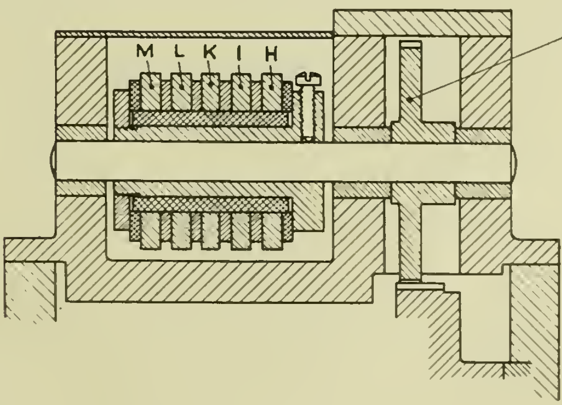


Fig. 7



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Serial No.
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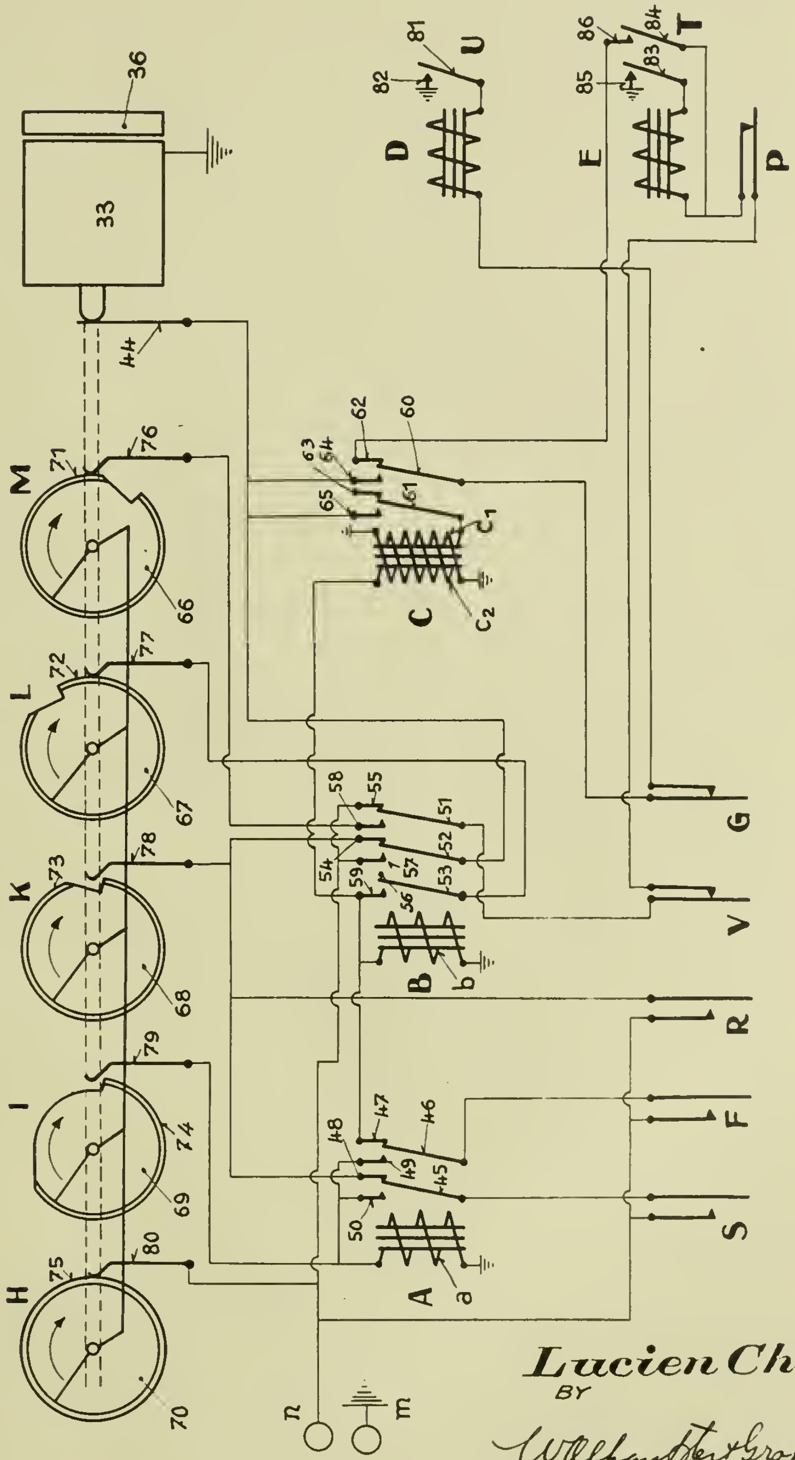
5 Sheets-Sheet 4

Fig. 8.



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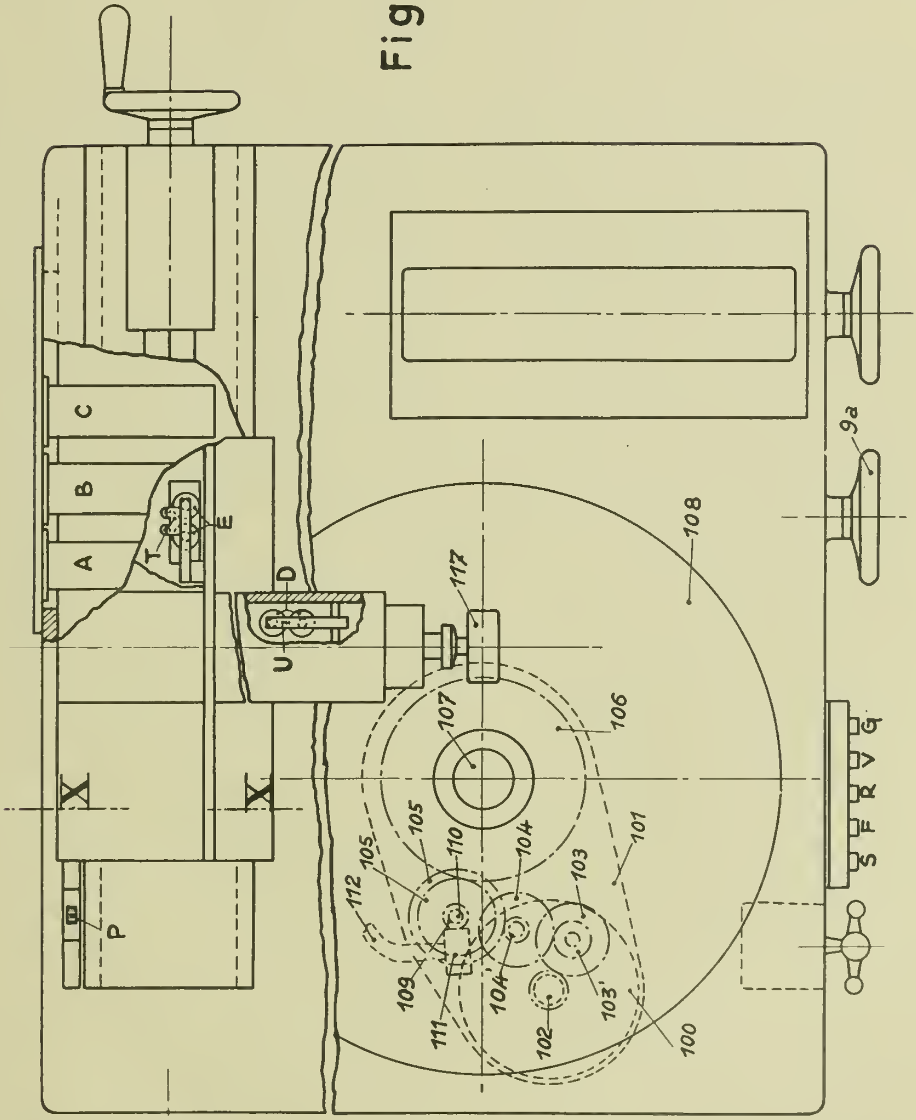
CARRYING CARRIAGE
Filed Oct. 27, 1942

Serial No.
463,571
5 Sheets-Sheet 5

Fig. 9



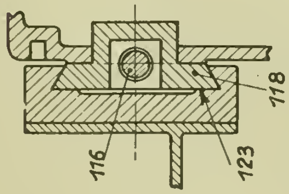


Fig. 10

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Published June 8, 1943

Serial No. 463,572

ALIEN PROPERTY CUSTODIAN

RECORD CARRIER DRIVE FOR SOUND TRACK REGISTERING MACHINES

Lucien Chanal, Annecy, France; vested in the Alien Property Custodian

Application filed October 27, 1942

As is well known, in sound track registering machines, the speed of revolution of the platform supporting a disk-shaped record being engraved should be as constant as possible. It is in particular absolutely imperative to preclude all vibrations and periodic variations of the speed of revolution because such periodic variations as for example those caused by the coming of gear teeth into meshing relation are perfectly perceptible when afterwards playing the record. It has even been noticed that the very unevenness of balls used in registering records generates vibrations which are detrimental to a high grade registration. Therefore in order to permit the achievement of a perfect registration on records, it is necessary to avoid, on the one hand, the transmission of vibrations set up by the motor and gear to the record-carrying platform and, on the other hand, the occurrence of any variation in the speed of revolution of said platform.

Devices created heretofore to fulfill the aforesaid requirements are generally very complicated and hard to assemble and adjust while not being entirely satisfactory because whereas the vibrations from the motor and the variations of its power torque are not actually transmitted to the platform, yet the vibrations generated by frictions arising between the stationary and movable portions of the platform spindle bearings may be propagated to said platform.

An object of the present invention is to provide a new or improved device obviating the aforesaid disadvantages and adapted to uniformly drive the record-carrying platform of a sound track registering machine, wherefor said platform is pivotally supported or revolubly fulcrumed on a vertical pin or stem rigid with a frame and has point or tangential contact at its center on a bearing surface provided endwise on said pin.

Another object of the invention is to provide a driving device as aforesaid adapted to minimize frictions and to inhibit the generation of vibrations such as those produced by multiple fulcrum bearings, means being provided for preventing motor vibrations and instantaneous speed variations from being transmitted to the record carrier.

A further object of the invention is to provide a driving device as aforesaid wherein swift and small amplitude oscillations are nullified by the high inertia of the record-carrying platform.

And a still further object of the invention is to provide a record carrier driving device as aforesaid made up of parts so constructed in a rugged and durable way and so mutually combined as to afford comparative important advantages so far as easiness of assembly, dismantling and adjustment are concerned.

With these and such other objects in view as will incidentally appear hereinafter, the invention comprises the novel construction, combination and arrangement of parts that will now be described in detail with reference to the accompanying diagrammatic drawing exemplifying a convenient embodiment of the same and forming a part of the present disclosure.

In the drawing:

Figure 1 is mostly an axial sectional view of the device in its entirety.

Figure 2 is a fragmentary sectional view on the line II—II of Fig. 1.

As shown in Fig. 1, the platform 1 adapted to carry a record (not shown) to be sound registered by a conventional engraving process capable of producing a modulated track or furrow is centrally supported in equilibrium upon an axial bearing comprising a ball 2 housed in a conical recess formed in the upper end of a vertical pin or stem 3 rigidly set into a socket 4a on the base frame 4. Said socket 4a is of sufficient length to hold the pin properly guided and centered and to ensure perfect steadiness thereof in its upstanding position.

The pin 3 has a pair of bearing surfaces 5, 6 separated by a reduced portion and tightly fitted in a bushing tucked up into a hollow hub portion 1a extending downwardly from and rigid with the platform 1.

Integral with the base frame 4 are three posts such as 7 on which the motor and speed reducer or gear unit of conventional structure (not shown) is supported by means of damping or cushioning blocks comprising resilient washers 8 (made for example of natural or synthetic rubber) shrunk into recesses formed in the lower surface of a bed plate 9. An elongated bush 10 threaded at both ends permits the washers 8 to be properly centered and clamped home in their recesses by means of nuts 11. Dowels 12 having threaded ends screwed into bores in the posts 7 and a smaller diameter than the inner diameter of the bushes 10 permit the bed plate 9 to be set and clamped at the required level in a horizontal plane by means of upper and lower nuts 14, 15.

It will be understood that, owing to this arrangement, no vibration from the motor and speed reducer gear casing can be transmitted to the frame and consequently to the record carrier 1.

The motor casing comprises the bed plate 9 on which the motor of known type (not shown) as well as the associated gear also of known type (not shown) which transmits the power torque to the record carrier 1 and revolves the same at suitable speed are supported. For the sake of clearness of the drawing, only a horizontal toothed wheel 16 and adjacent parts driving the platform 1 without transmitting torque varia-

tions are shown but it is believed that the remainder of the structure will be clearly understood from anyone skilled in the art.

The toothed wheel 16 is rotatably supported by means of bushes 17 fitted in the bed plate 9 and in the lid 18 of the motor casing. In said wheel 16 is formed a central recess having a sufficient diameter to provide ample space for snugly receiving the hub 1ª of the platform 1 without any risk of contact.

The upper end of the hub 16ª of the wheel 16 projects from the motor casing and carries, rigidly secured thereto by screws (not shown) the driving element of a coupling comprising a trough-shaped member 19 containing a suitable liquid of appropriate viscosity. Inside this member 19 is accommodated the driven element of the coupling, which element is fixed by screws (not shown) or the like to the platform 1. The driven element of the coupling also comprises a trough-shaped member 20 whose walls run parallel to those of the trough-shaped member 19 and are immersed in the liquid therein contained.

The record-carrying platform 1 is driven through a pair of motion transmitter rollers 21 diametrically opposed to each other and keyed to lugs rigid on the driven element 20, the latter being fixed in turn to the platform 1 by screws (not shown). Each roller 21 is embraced by a pair of blade springs 22 firmly secured at their lower ends to the trough-shaped member 19 forming the driving element of the coupling. The distortions of said blade springs are limited on both sides of a balanced position by stops 23 (Fig. 2) having a slightly convex inner face 24 to enable said blades to come into resting engagement thereagainst. The outline of the faces 24 is so selected as to cause a relatively small motion of the roller 21 to correspond to a large variation of the blade spring behavior owing to a change of its free length.

The operation of the device takes place very simply as follows:

When the motor operates, it drives through a gear of known type (not shown) the wheel 16 and trough-shaped member 19. The record-carrying platform 1 is revolved through the blade springs 22 and the rollers 21 frictionally embraced thereby. When starting, as the platform inertia is considerable, the springs 22 yield off and come into contact with the stops 23 so that the drive becomes rigid until normal running conditions are reached. Afterwards the effort transmitted from the motor is reduced to that required for keeping the carrier in motion and overcoming the resistance thereon due to the engraving action on the record. Such resistance is extremely small. The rear spring which up to then was tight is raised, whereupon the roller moves to its balanced position (shown in the drawing). However, before reaching said position, the roller 21 comes into contact with the front spring whose flexional stress checks that of the rear spring.

It will be seen that shortly before reaching its position of equilibrium, the roller 21 assumes a position in which the resultant of the flexional stress of the springs exactly balances the driving stress, whereafter the platform 1 revolves at the same angular speed as the trough-shaped member 19.

In order that said position of equilibrium of the roller 21 should be well determined, the outline 24 of the stops 23 is so selected as to cause a small relative angular motion of the trough-shaped members 19, 20 to correspond with a large variation of the flexional stresses of the springs 22.

Quick oscillatory motions cannot be produced because the power torque is transmitted not by a single free spring but by a pair of oppositely acting springs whose resultant oscillation cycle has been so selected as to be very long. Such resultant cycle is further combined with the resultant cycle of the group of springs arranged at the other end of the same diameter, so that the final resultant has an extremely long cycle which is checked by the action of the fluid contained in the trough-shaped member 19. As a matter of fact, since the walls of said member 19 are parallel and quite close to those of the trough-shaped member 20, the fluid viscosity counteracts any substantial relative displacement between the members 19 and 20.

Quick and small amplitude oscillations are nullified by the high inertia of the record-carrying platform 1.

Moreover, as the platform 1 rests at its center on one point only, there can be no vibration or concomitant attrition (eating away) due to torque-acting frictions on facing parts as in the event of multiple fulcrum abutments. There can neither be any torque variation due to unevenness of the bearings or contacting surfaces. As the record-carrying platform is very heavy (about twenty to thirty kilograms) it is obviously necessary that those surfaces on which the ball 2 rests should be properly ground to true shape and suitably treated. Practical tests have shown, however, that there can be no premature wear of the contacting surfaces provided proper lubrication is effected.

It will be noticed that so far as adjustment, assembling and dismantling are concerned, the device according to the invention presents as above pointed out substantial advantages by comparison with known devices for similar purposes. A summary of said advantages is given hereafter:

As the platform 1 merely rests upon the ball 2 and is not held by the parts actuating the same to the driving element of the mechanism, it can be readily lifted and withdrawn from the pin 3, this permitting free access to be gained to the motor and gear unit which can be easily removed. As the motor casing is supported at three points, it is an easy task merely by adjusting the nuts 14 to proper levels so to arrange the trough-shaped member 19 as to cause it to revolve in true horizontality. Any suitable number of posts 7 may be provided for supporting the bed plate 9 of the motor casing.

It will be obvious from the foregoing that the ball bearing surface 2 may be arranged at any suitable level along the pin 3. However, it is advantageous, from the point of view of record carrying stability, that the contacting point between the ball 2 and platform 1 should lie flush with or higher than the center of gravity of said platform and hub extension 1ª.

More than two rollers such as 21 cooperating with a pair of blade springs such as 22 might be provided, said multiple rollers being then advantageously located on a circumference and separated by equal distances, the center of said circumference being coincident with the pivotal axis of the coupling which in turn coincides with the axis of the record carrier.

LUCIEN CHANAL.

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JUNE 8, 1943.

BY A. P. C.

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RECORD CARRIER DRIVE FOR SOUND TRACK REGISTERING MACHINES
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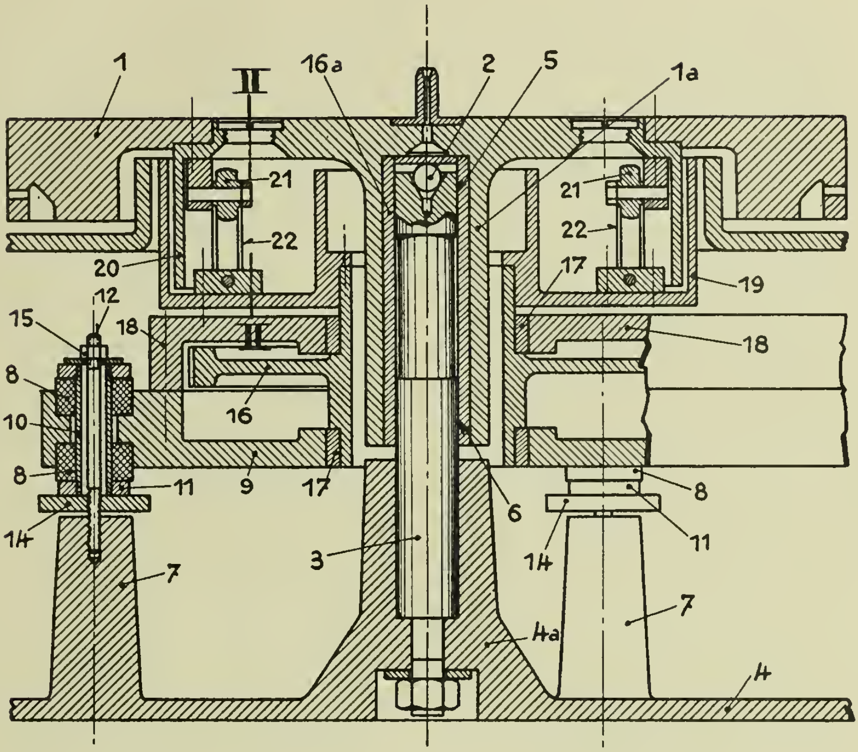
Serial No.
463,572

Fig. 1



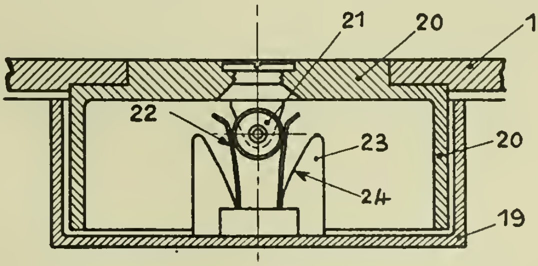


Fig. 2

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ALIEN PROPERTY CUSTODIAN

RECORD ENGRAVER SUSPENSION FOR SOUND TRACK REGISTERING MACHINE

Lucien Chanal, Annecy, France; vested in the Alien Property Custodian

Application filed October 27, 1942

As is known, in a machine for registering a sound track on a disk-shaped record, the chisel or like tool carried by the engraver cuts into the record a furrow of triangular cross section whose apex angle is approximately equal to 90°. Such furrow should have a practically constant depth and width even when the record revolves in an imperfect plane. Therefore suspension means should be provided for the engraver so as to enable it closely to follow the motions of the record while keeping the tool applied with a given pressure upon the record for the purpose of cutting a furrow having the required depth. However, the cutting of the furrow produces a reactive stress which tends either to lift the tool off or to engage it more deeply depending upon the position of the engraver pivot with respect to the cutting position of the tool. Such reactive stress is the greater as the section of the cut chippings, i. e. the furrow depth is itself larger. Moreover, as the record surface is warped, it is necessary in order to obtain a furrow of uniform depth to arrange for the engraver to truly follow the up and down motions of the record. Since the tool must stand up almost at right angles to the record so as to cause the furrow to be correctly cut and since it can be assumed that the record never revolves in a perfect plane, pendulary movements are unavoidably generated and gnawing of the engraver ensues. Instead o: representing a helix, the furrow edge then represents a sinusoid.

An object of the present invention is to provide a new or improved suspension device for the engraver in machine for registering a sound track on a reco. , said device being adapted to obviate the aforesaid disadvantages owing to the operative connection of the engraver-carrying arm with damping or cushioning means, said arm being arranged for free pivotal motion about an axis approximately parallel to the record surface and having a position relative to the cutting point so selected as to cause the cutting reaction to nullify the force which urges the tool against the record.

Another object of the invention is to provide a new or improved suspension device as aforesaid wherein the damping or cushioning means are so arranged as to cause the damping action on such up and down motions of the engraver-carrying arm as are produced by the record warping to vary in response to the height of the cutting point with respect to the height of the pivotal axis of the engraver-carrying arm, thereby preventing pendulary motions from being initiated.

A further object of the invention is to provide a new or improved suspension device as aforesaid wherein the engraver is left sufficiently free to follow the record throughout the up and down motions due to the unevennesses of its surface and at the same time applies a sufficient damping stress to the engraver unit twice per revolution to brake down to total elimination pendulary oscillations as may be produced by reactive stresses due to the cutting action.

And a still further object of the invention is to provide a new or improved suspension device as aforesaid having a perfect efficiency due regard being paid to the fact that the engraver vibrations ase similar to the Larsen or self excitation phenomenon and therefore require a fairly long time to reach a substantial amplitude, whereby as said time is much greater than the duration of half a revolution of the record between two maximum damping effects, the braking action can always occur quickly enough.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel construction and combination of parts that will now be described in detail with reference to the accompanying diagrammatic drawing illustrating a convenient embodiment of the same and forming a part of the present disclosure.

In the drawing:

Figure 1 is a sectional view of the entire device on the line I—I of Fig. 2.

Figure 2 is a sectional view on the line II—II of Fig. 1.

Figure 3 is a sectional view on the line III—III of Fig. 1.

Like reference characters designate like parts throughout the several views.

As illustrated, 1 is the engraver, 2 is the chisel or cutting tool carried thereby, 3 is the surface of the record to be engraved, 4 is the engraver-carrying arm pivoted between pointed bearings 6, 6 which are so adjusted as to hold the arm perfectly free to rock but devoid of play and sway.

The pivotal axis of the engraver-carrying arm 4 is substantially parallel to the record surface and its position with respect to the cutting point of the tool 2 is so selected as to cause the reaction of the cutting stress for the required depth of cut to nullify the torque due to the force which urges the tool against the record. Moreover, said axis is so arranged relative to the mass of the engraver-carrying arm 4 and engraver itself as to bring down the inertia of the unit to a low value, whereby the engraver 1 can follow the variations of height of the cutting point due to record warping.

The engraver arm 4 is operatively connected to a damping device. To that effect, the arm 4 carries at one of its ends one element of a damper comprising a board or panel 7 immersed in a mass of fluid (preferably a liquid) filling a container 8. Between the walls of the container 8 and the board 7 is left a throttled clearance which enables this board to follow the vertical motions of the engraver carrier 4 responsive to unevennesses due to warping of the record 3. The size of said clearance is calculated to match the desired degree of damping and the viscosity of the fluid in the container 8.

In order to permit the depth of cut of the tool 2 to be adjusted at will, a spring 11 is fastened to a lug 13^a rigidly secured to the engraver-carrying arm 4. The tension of the spring 11 can be regulated by means of a screwed spindle 12 and a nut 13 fitted thereon. Said spring tension tends to properly sustain the engraver.

A cam 14 fast upon a pin 15 forming one limb of a cranked lever 16 enables the engraver to be lifted off the work to inoperative position. By rotating the cranked lever 16 clockwise (as viewed in fig. 1) the cam 14 is brought into engagement with a ledge 17 on the engraver arm 4 and raises the latter.

In order to automatically control the setting of the engraver into operation, there is coiled around the pin 15 a sufficiently strong spring 20 to rotate the cam 14 in a direction capable of lifting the engraver. For holding the engraver tool 2 upon the record 3 in proper cutting position, i. e. for maintaining the cam 14 in the illustrated position against the action of spring 20, a mechanical latch (not shown) or electromagnetic means as shown in fig. 1 may be provided.

When the engraver 1 is in normal position (as shown in the drawing) to cope with an average record height, the damping board 7 extends at right angles to the walls of the container 8. At least one of the container walls such as the one designated by 10 is not parallel to the path described by the board edge during its motions but is so disposed with respect to said path as to cause the clearance between the board 7 and said wall to be minimum when the engraver 1 is in normal position. To that effect the wall 10 extends parallel to the plane which is tangent to the cylinder of revolution generated by the edge 9 of the board when the engraver is moved vertically along a generatrix corresponding to the position assumed by said board when the engraver is in normal position. It will be seen that when the engraver 1 is moved up or down from said position, the damping effect gradually dwindles down.

It will be understood that as the warped record describes a complete revolution, the engraver 1 traverses its lowermost position once, its uppermost position also once and its normal position twice. Consequently the damping effect varies periodically, the duration of a period or cycle corresponding to the duration of half a revolution of the record. Moreover, the variations of the damping effect are such that when the engraver occupies its extreme positions (up or down) said effect is minimum while it is maximum when the engraver occupies its middle position. In other words, assuming the engraver to occupy those positions for which the damping effect is minimum, the engraver has a maximum of freedom, which enables the same to exactly follow the record unevennesses due to warping. Conversely, when the engraver occupies its middle position for which it can bear a larger damping effect since its motion is uniform when it traverses said position, the damping effect is maximum.

It will be seen from the foregoing that a device as above described leaves the engraver a sufficient degree of freedom to enable it to follow up and down the unevennesses of the record and that twice per revolution it applies to the assembly a sufficiently large damping effect to fully brake down those pendulary oscillations which might be caused by the reactions due to the cutting action.

The efficiency of the assembly is fully satisfactory because the engraver vibrations are similar to a Larsen phenomenon and involve self excitement, i. e. require a fairly long time within which to reach a substantial amplitude. As such time largely exceeds the duration of half a revolution of the record which separates two maximum damping effects, the braking action always takes place quickly enough.

As an alternative construction, the manually operable cranked lever 16 may be preserved while the spring 20 is omitted.

Safety means are provided for preventing the engraver from remaining in cutting position as long as all steps necessary for effecting a registration have not been taken. Such means comprise in one embodiment as shown in fig. 1 a double electromagnet 22 whose movable armature 21 is rigidly connected to the pin 15, the angular setting of said armature relative to the cam 14 being so provided that when this armature is "stuck", the cam should be clear from the ledge 17.

The winding of the electromagnets 22 is energized only when all steps required for effecting a registration on a record have been fully taken, as set forth in a co-pending application.

Therefore the engraver while being normally raised by the spring 20 is kept down only when the electromagnets 22 are energized and their movable armature 21 is held "stuck" against the action of said spring 20. Therefore the engraver can be brought into operative position only if the electric current flows through the electromagnet windings. As the switching on of said current into the magnets 22 is dependent upon the setting of the registering machine into service, no unskilful manipulation is possible.

LUCIEN CHANAL.

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RECORD ENGRAVER SUSPENSION FOR SOUND TRACK REGISTERING MACHINE

Filed Oct. 27, 1942

Serial No. 463,573

Fig. 1

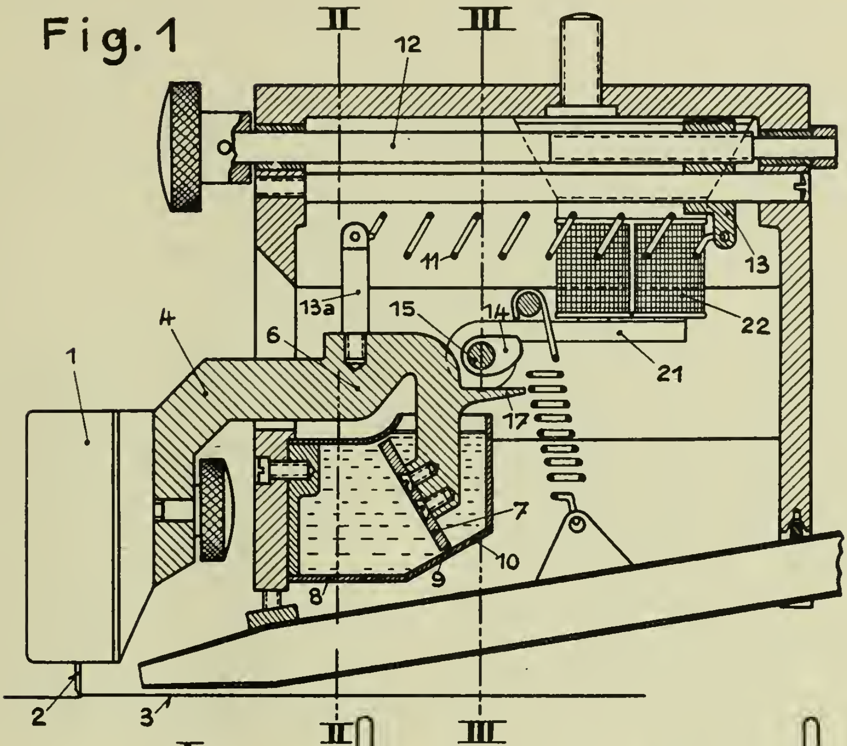


Fig. 2

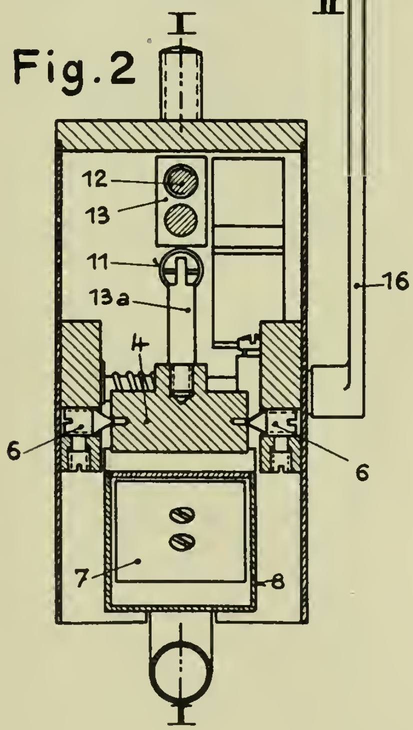
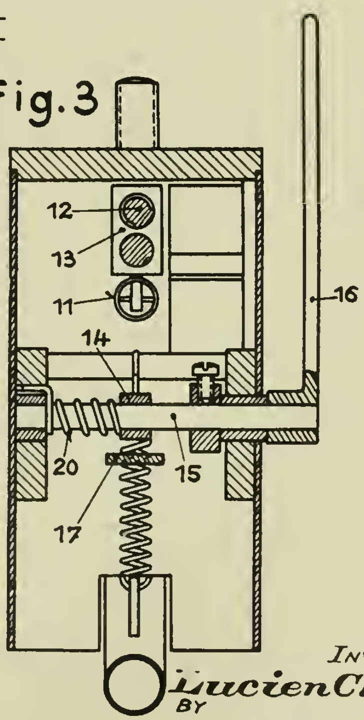


Fig. 3



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Published June 8, 1943 Serial No. 464,750

ALIEN PROPERTY CUSTODIAN

SYSTEMS FOR USE IN CONNECTION WITH TELEVISION AND THE LIKE

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Application filed November 6, 1942

The present invention relates to systems for use in connection with television and the like.

An object of the invention is to provide an oscillation generator systems, with means and methods for the adjustment thereof, to be more especially, although not exclusively, applied to the transmission of television picture and line signals, such a system being better adapted to meet the requirements of practice than those used for the same purpose up to the present time, and being in particular more stable.

With this object in view, according to a feature of the present invention, in systems of the frequency demultiplier kind, that is to say systems including a plurality of oscillators cooperating together so as to supply at least two utilization frequencies affording a given ratio of demultiplication or multiplication, I have recourse, in order to adjust the frequencies of the various oscillators, to means adapted to act simultaneously on those of their respective elements upon which the successive frequencies that are produced depend, so as imperatively to maintain the ratios of said frequencies, and, in particular, I impress perfectly determined and adjustable voltages upon said elements, for instance by means of a potentiometer common to the various oscillators.

According to another feature of the invention, relating to systems of the type above referred to, for producing at least one given frequency, especially those for television picture and line signals, I superpose to this frequency a standard frequency (for instance that of an alternating current distribution system), and I cause the resultant frequency to react (preferably after detection) on the elements of said system upon which depends the frequency to be produced.

Another object of the present invention is to provide a frequency demultiplier or multiplier which maintains the frequency conversion ratio in a more accurate manner than in the systems used for the same purpose up to the present time.

With this last mentioned object in view, according to a feature of my invention, I have recourse to a series of oscillators connected to one another according to multiples or sub-multiples of the fundamental frequency. the oscillations being preferably of the saw teeth type in order to increase the accuracy of the synchronism, and I combine with such an assembly means for controlling the frequency conversion ratio, these means including at least one oscillograph the series of plates of which can be coupled at will respectively with at least two of the oscillators, so as to bring into light the synchronism, according to the appearance of the resultant curve.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagram of a system for the transmission of synchronisation signals for television, this system being made according to the invention;

Fig. 2 is a curve illustrating the saw-teeth voltage supplied by the first stage of the system of Fig. 1 and the frequency of which is to correspond to that of the line signals;

Fig. 3 is a curve similar to that of Fig. 1 illustrating the production of the picture synchronizing signals obtained at the output end of the systems;

Fig. 4 is a curve illustrating the voltage of an alternating current distribution system to be superposed, according to a feature of the invention, to the picture synchronizing signals produced by a system of the kind of Fig. 1;

Fig. 5 is a similar curve illustrating the result of this superposition of voltages;

Fig. 6 diagrammatically shows the whole of a line and picture frequency generating system for use in television, and of a device for the control of the frequencies, this arrangement being made according to the invention;

Fig. 7 diagrammatically shows the relaxation tubes which can advantageously be used in such a combined system according to the present invention;

Fig. 8 is a view, similar to Fig. 7, showing similar tubes made according to a modification.

I will first describe a system according to the invention for the production of oscillations for transmitting synchronizing signals (corresponding to pictures and lines) for television.

First, it should be reminded that it is known in the art to make use, for this transmission, of a series of multi-vibrators or relaxation oscillators the first of which supplies the frequency which is to correspond to the scanning of the lines (for instance $441 \times 50 = 22050$, if it is desired to obtain 441 lines in each picture and 50 pictures per second) while the others are synchronized to frequencies which are sub-multiples of the first, so as finally to supply the frequency of the picture synchronizing signals, to wit 50 per second.

For instance, in a given arrangement, the system includes, after the first oscillator, tuned to the frequency of 22050 per second, four oscillators respectively synchronized to the following frequencies:

$$\frac{22050}{7}=3150;\ \frac{3150}{7}=450;\ \frac{450}{3}=150;\ \text{and}\ \frac{150}{3}=50$$

However, this kind of arrangement involves a certain number of disadvantages. In particular, if the frequency of the first oscillator varies by a value equal to $\frac{1}{7}$ of its value, due for instance to a voltage adjustment, the second oscillator suddenly ceases to correspond to the sub-harmonic of order 7 so as to correspond to the adjacent sub-harmonic of order 6 or 8, whereby the scanning is wholly modified.

In order to obviate these drawbacks, according to the invention, the respective oscillators are caused to coact with regulating means such that they imperatively maintain the ratios between the successive frequencies.

For instance, if the frequency of each of said oscillators depends upon the discharge speed of a condenser, as it is the case with oscillators or multi-vibrators of the relaxation type, this speed being itself a function of a voltage impressed, for instance, upon one of the electrodes of the tube or of one of the tubes of the corresponding oscillator, said means will consist in regulating the above mentioned voltages of the respective oscillators from a common device, such for instance as a potentiometer.

It goes without saying that such a result can be obtained in many different manners depending in particular upon the nature of the oscillators that are utilized.

In Fig. 1, I have shown a group of multi-vibrators or relaxation oscillators, of a type known in itself, the first two oscillators only being visible on the drawing.

Compartment I contains the main oscillator. Condenser 1 discharges slowly into pentode tube 2, and it is charged suddenly through tube 3 during the short time for which the latter is not fully blocked by its polarization. An auxiliary tube 4 may be provided, as it is known, for accelerating the beginning of the charge. Finally, the discharge speed, which determines the frequency, is initially regulated through any known means, for instance by adjusting the screen voltage of tube 2, which determines the value of the plate current. This adjustment is effected by means of a potentiometer 5 or through any other means.

Finally, I obtain, at the output end of the first compartment, at A, a voltage which has, for instance, the saw-teeth shape illustrated by Fig. 2 and which is utilized for the line synchronizing signals, its frequency having been suitably adjusted for this purpose.

Compartment II, which is connected to the first compartment through a capacity or other coupling, includes similar elements 1′, 2′, 3′, 4′, as the first compartment. However, the capacity of condenser 1′ is greater in such manner as to supply a lower frequency, with the demultiplication ratio that has been chosen. Furthermore, in order to transmit the voltage of compartment I, there are provided means such as a tube 6 or the like for ensuring synchronizing, by frequency demultiplication, of compartment II with compartment I.

Compartments III, IV, etc. in turn supply demultiplied frequencies. The last one produces, at its output end, at B, a voltage at the frequency of the picture synchronizing signals, for instance 50 per second and in a form illustrated by the curve of Fig. 3.

Such a system having been provided, it is then combined, as above stated, with a common adjustment potentiometer, through which the individual potentiometers 5, 5′, etc. are fed, instead of having them controlled, in the usual manner, by the high frequency of the station.

It will be readily understood that with this adjustment common to the various compartments, it is possible simultaneously to vary the respective discharge of condensers 1, 1′, etc., by proportional amounts, which also ensures proportional displacements of all the intermediate frequencies of the system.

Thus is ensured the maintaining of the ratio of the extreme frequencies, but it should be well understood that all other assemblies giving the desired result might as well be employed according to the invention.

Such a system can be employed such as above explained, but, advantageously, I further make use of other features such as the following, which might eventually be employed separately.

According to one of these features, which will be supposed to be applied to a system of the type above described, I have recourse, for stabilizing the frequencies generated by said system, to means utilizing the superposition of a standard frequency for reacting, in a suitable manner, upon the elements upon which depends the value of said frequencies.

Thus, considering the voltage of the picture synchronizing signals, obtained at the output end of the system at B, which, in the example that has been chosen, varies at a frequency which is supposed to be of 50 periods,

a. there is superposed to this voltage, by means of a suitable mixing device 8 of a known type, the alternating sinusoidal voltage of a distribution system of 50 periods frequency (Fig. 3), this superposition giving rise to a combined voltage as illustrated by Fig. 4;

b. there is effected, through any suitable means, a detection of the tops of the curve of this resultant voltage which detection is to produce a constant rectified continuous voltage, if both of the component frequencies remain the same, but, on the contrary, a variable voltage if dephasings take place due to variations between these two frequencies, and

c. the voltage that is obtained is caused to act upon at least one of compartments I, II, etc. or upon each of these compartments, and that through one of the elements upon which the frequency depends, for instance the control grids of tubes 1, 1′, etc., as shown by the drawing.

In the example illustrated by the drawing, it has been supposed that detector 9 includes a diode tube 10 and that the negative rectified voltage 11 is utilized for polarizing, with suitable couplings shown at 12, 12′, etc., said control grids, the whole being arranged in such manner that an action is obtained upon the discharge speed of condensers 1, 1′, etc. in a correcting direction, that is to say in such manner as to bring the final frequency of signal B to a value equal to that of the distribution system.

In order to obtain this result, it suffices that, if the signals succeed one another at time intervals shorter than it is desired, the discharge speed of I should be reduced, which corresponds to tube 2 being more polarized, that is to say the absolute value of negative voltage 11 being in-

creased. Now, an examination of Fig. 4 shows that this is what takes place when the signals tend to move toward the left, since the maximum ordinate of their tops then tends to increase.

Whatever be the particular arrangement that is chosen, I obtain a system the operation of which results sufficiently clearly from the preceding explanations for making it unnecessary further to describe it. This system has, over those existing at the present time, many advantages, and in particular that of ensuring a better stability of the frequency.

On the other hand, it is known that, in a television system, it is necessary to obtain a very sharp synchronism relation between the two extreme frequencies, that is to say, in particular, the frequency of the lines and the frequency of the pictures, the second of which must be, very accurately, a sub-multiple of the first. The degree of synchronism that is required is especially important with the interlacing method, the efficiency of which is wholly nullified if the end of a picture, for instance, is not obtained for exactly the same position of a line of a given number.

According to a feature of the present invention, in order to obtain the desired result, the whole of the oscillator system is first arranged in such manner as to include a fundamental generator coupled with a series of generators of respective sub-multiple frequencies, which are interrelated to one another, as precedingly described.

These generators are preferably such that they supply a saw-teeth curve because such an arrangement permits of increasing the accuracy and the stability of the interrelation between the generators, and therefore the synchronism.

It suffices to utilize for this purpose any known device, of the relaxation or other type with ordinary tubes mounted as multivibrators or tyratrons.

If it is supposed, by way of example, that it is desired to obtain, in the interlacing method, an analysis corresponding to 441 lines and 50 half pictures per second (therefore 25 complete pictures per second) I may make use of a fundamental generator C (Fig. 6) giving a frequency of:

$$f=441\times 50=22.050 \text{ cycles}$$

and to which are successively connected generators D, E, F, G; giving the following sub-multiple frequencies:

$$\frac{22050}{7}=3150$$

$$\frac{3150}{7}=450$$

$$\frac{450}{3}=150$$

$$\frac{150}{3}=50$$

the last one giving the picture frequency.

Instead of making use of a fundamental generator of a frequency equal to f, I might make use of another generator of different frequency, for instance

$$\frac{f}{2}$$

as shown at C′ on Fig. 6.

In Figs. 7 and 8, I have shown, merely by way of example, two mountings corresponding to the use of tyratrons.

According to the embodiment of Fig. 7, the synchronizing signals coming from the preceding generator are applied to the grid of tyratron U through a condenser 31. The leak resistance is shown at 32 and adjustment resistance at 33. The plate of the tyratron which is connected with high voltage HT through an adjustment resistance, returns to the mass through a condenser V. The cathode circuit is positively polarized. The saw-teeth signals coming from said plate (and diagrammatically shown on the drawing) are then transmitted through a condenser 34 to the grate of a tube 35 which feeds, with the usual phase difference of 180°, a saw-teeth current (also shown by the drawing). These signals are finally transmitted to the next generator and so on.

Fig. 8 shows an analogous system in which the same reference numerals designate the same elements. The only difference lies in the fact that the signals, indicated on the drawing result from the practically instantaneous charge and discharge of cathode U. By using preferably in the cathode circuit a resistance R, I obtain in said circuit very short signals (top of Fig. 8) corresponding to the successive discharges of condenser V; these signals are utilized for synchronizing the next generator.

Such systems produce saw-teeth curves of very sharp shape which are well adapted to the desired purpose.

With a series of such generators or any analogous arrangement, I combine means for checking the accuracy of the synchronism, that is to say the demultiplication, which means are constituted by at least one cathode oscillograph the plates or series of plates of which may be coupled at will with at least two of the various generators. I can thus bring into light the synchronism that is obtained, in accordance with the aspect of the resultant curve visible in said oscillograph.

For instance, considering such an oscillograph O^1 (Fig. 6) and supposing (also by way of example) that two of the plates of said oscillograph are earthed, it will be seen that if the two other plates are respectively connected to generators C and D, I obtain on the screen of the oscillograph a Lissajou curve which, when the demultiplication $1/7$ is ensured in an exact manner, must be constituted by seven teeth, for instance, in the horizontal direction (that is to say with sharp vertical ridges).

If now, without modifying the connection between generator D and the corresponding deviating plate, I connect the other plate to generator E, I must obtain, under the same conditions, a resultant curve having seven teeth, in the vertical direction.

Of course, it is advantageous, in order to permit of working quickly, to make use of a switch such as *a*, including a suitable number of contact studs, for instance three, if it is desired to be able to check the synchronism between C and C′, when a generator such as C′ has been provided.

The same checking operation can be performed with the following generators such as E, F, G, and this either with another oscillograph O^2 as shown, or by means of the same oscillograph O^1 associated with the switch *a* including a suitable number of contact studs.

Anyway, whatever be the particular embodiment that is finally chosen, I obtain a system the operation of which results sufficiently clearly from the preceding operations for making it unnecessary to enter into further details.

This system has over prior systems used for the same purpose, the following advantages:

(*a*) it ensures an easy, quick and very exact checking of the demultiplication ratio, that is to say of the synchronism; and

(*b*) it renders that synchronism more effective, owing to the saw-teeth shape of the oscillations, which permits of connecting the various generators with one another in a safe number.

Of course, I may utilize supplementary synchronizing means, for instance such as described in Figs. 1 to 6.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

HENRI DE FRANCE.

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JUNE 8, 1943.
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SYSTEMS FOR USE IN CONNECTION WITH
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3 Sheets-Sheet 1

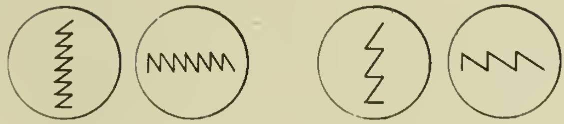
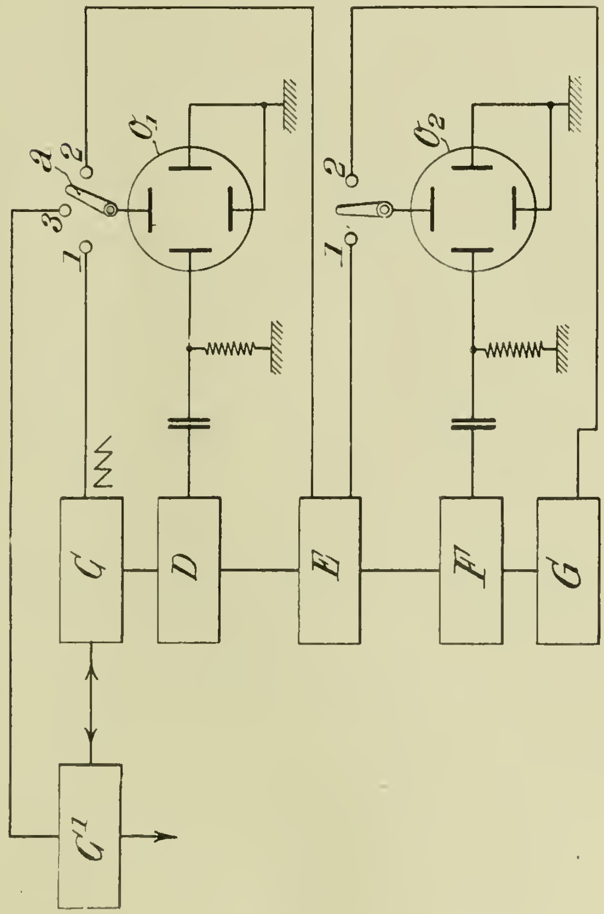


Fig.6



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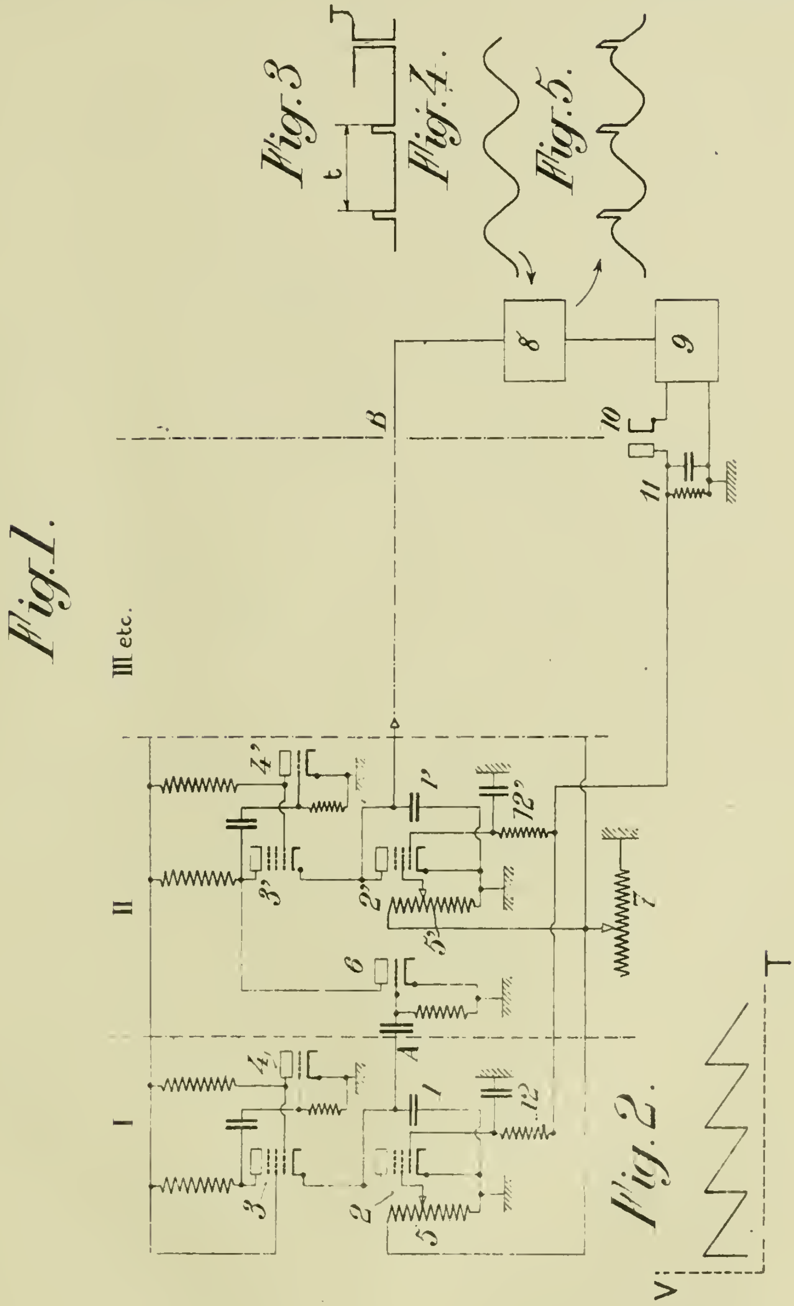

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Fig. 7

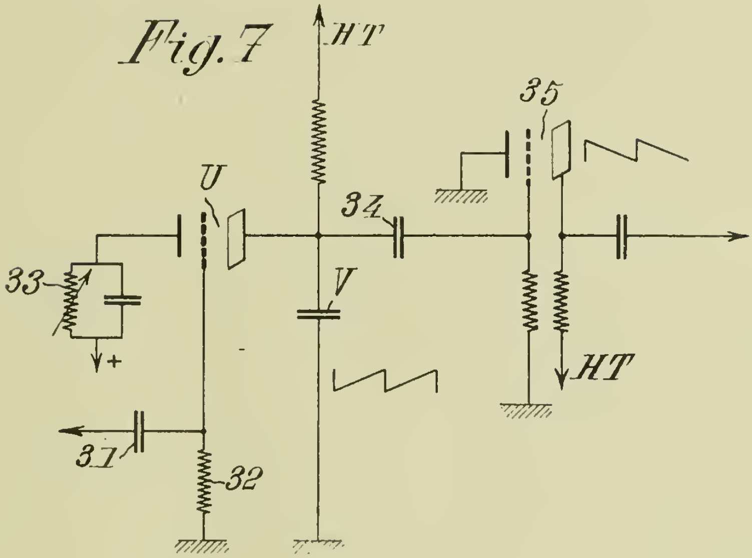
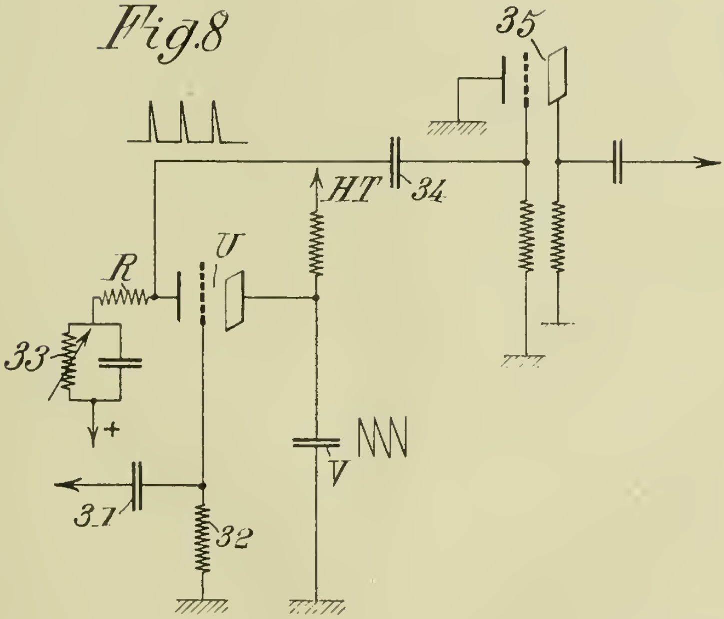


Fig. 8



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ALIEN PROPERTY CUSTODIAN

HINGED SKI

Henri Sarthou, Saint-Gervais-les-Bains, France; vested in the Alien Property Custodian

Application filed November 10, 1942

The hinged ski forming the subject-matter of the present invention is intended to facilitate turnings and to reduce accidents, in particular in the case of uncompacted, heavy, deep or powdery snows, which are the most dangerous kinds of snow for the average skier.

This ski is characterised by the fact that it is composed of two distinct parts constituting, one the toe and the central part, the other the heel, said two parts being joined end to end in alignment with each other and resiliently assembled in the lateral direction, in the same way as a steering rudder, but rigidly in the vertical direction.

According to a more particularly advantageous embodiment, the assemblage is obtained by means of a thin flexible steel blade placed on edge in the longitudinal axis of the ski and capable of being secured to both sections or parts of the ski in any suitable manner, for instance by means of angle irons riveted to said blade and screwed on both sections of the ski.

The flexible connecting blade might also be embedded in the two parts or sections and according to the longitudinal axis of the ski.

In this first embodiment, the rear of the front section has the shape of a re-entrant angle and the front of the rear section that of a smaller projecting angle, so as to allow a lateral displacement of the rear section or heel by the latter pivoting about the apices of the angles. The angular junction and pivotal surfaces are preferably cut on a bevel.

In a second embodiment, a real axis for the lateral pivoting of the rear part or heel is provided, the surface separating both sections of the ski being co-axial with said axis and devised in such a manner as to provide a sliding fitting or guiding arrangement of said two sections.

The separating surface can be vertical, inclined or broken, with, eventually, one of the sections straddling the other.

The sliding fitting or guiding arrangement of both parts or sections of the ski is obtained, in particular, by means of plane or shaped metal blades embedded midway in the wood in both sections. Said sliding fitting or guiding arrangement can be plane, inclined, shaped at a right angle or of another type.

In said second embodiment, the front section is axially extended rearwardly by a metal armature pivoted on the vertical hinge of both sections of the ski and extended beyond said hinge to receive at least one resiliently distortable blade guided at its free end in a fork-piece rigid with the rear section or heel.

The relative angular displacements of both sections of the ski are limited by abutments.

The length of the rear section is preferably comprised between $\frac{1}{6}$ and $\frac{1}{10}$ of the total length of the ski.

In a constructional modification, the rear section of the ski can also be divided into at least two parts hinged as previously indicated for the front section and the rear section of the two first embodiments.

In another modification, the rear end of the rear section can be pivoted on the latter and be kinematically connected to the front section so that it is angularly and automatically displaced relatively to said rear section, but in reverse direction to the angular displacement of said rear section relatively to the front section.

Other particular points, also included in the scope of the present invention, will appear in the following text given with reference to the accompanying drawing, by way of example only, in which:

Fig. 1 is an elevation of a first embodiment of a hinged ski.

Fig. 2 is a section made according to line II—II of the preceding figure.

Fig. 3 is a plan view of the hinged ski illustrated in Fig. 1.

Fig. 4 is an elevation, with axial section, made according to line IV—IV of Fig. 5 and showing a second embodiment of a hinged ski.

Fig. 5 is a plan view corresponding to the preceding figure, the rear section being in alignment with the front section.

Fig. 6 is a view similar to the preceding one, both sections of the ski being angularly displaced relatively to each other.

In the form of construction, more particularly illustrated in Figs. 1, 2 and 3, the hinged ski is composed of two distinct wood members. The first member **2** forms the toe and the central part of the ski, the second member **3** forms the heel.

These two sections considered separately do not differ at all from the corresponding parts of an ordinary ski. By joining them together end to end, the rear of the central part **2** against the front of the heel **3**, a complete ski of the design actually used will consequently be obtained, which will have been sectioned in its lower part. The same result can moreover be obtained by taking an ordinary ski and by sectioning it between the heel and the central part.

The length of the heel member **3** is variable

and in relation with the total length of the ski. It can, for instance, be from 1/6 to 1/10 of the total length of the ski.

The rear of the central part 2 has the shape of a re-entrant angle and the front of the heel 3, that of a less obtuse projecting angle in order to allow a lateral displacement of the heel 3 about the apex 4 of the re-entrant angle of member 2 taken as pivotal axis. The male and female parts are both cut on a bevel.

The assemblage of the two sections is effected, in the embodiment illustrated which it seems must be preferred, by means of a thin and flexible steel blade 5, placed on edge or embedded in the longitudinal axis of the ski. Said blade 5 is secured to the ski by angle irons 6 riveted to the blade and screwed on both sections 2 and 3 of the ski, by leaving a slight clearance between them to impart greater freedom to the heel in the lateral direction.

The steel blade 5 can only bend in the lateral direction, but remains rigid in the vertical direction, the ski being assumed to be flat on the ground. The heel of the ski can therefore only move in the lateral direction and retains its entire rigidity in the vertical direction, whilst maintaining the natural flexibility of the ski throughout its length.

Owing to its position in the longitudinal axis of the ski, in position of rest and in straight line declivities, said blade 5 holds the heel straight in the general line of the ski. It is only at the skier's will and by the stresses he exerts for changing his direction that the heel, by the resistance of the snow to the lateral skidding of the entire ski, causes the blade to bend and moves laterally, in one direction or the other according to one of the arrows x or y and imparts a new direction to the toe, like the rudder acts on the front of a boat. The stress exerted by the skier ceasing at the end of the turn, the steel blade comes back by its resiliency into a straight line and straightens the heel in the general line of the ski.

In a second embodiment, more particularly illustrated in Figs. 4, 5 and 6, both sections 2 and 3 are shaped, at their point of junction, in an arc of circle 7 having for centre a spindle 8 about which the rear section 3 can pivot. This spindle is carried by a rigid bar 9 secured by means of screws 10 on the front section 2. Said spindle is therefore displaced rearwardly behind the junction line 7 and the bar 9 is extended by a tail-piece constituted by a spring blade 5 secured with a certain amount of play at its other end, in a fork-piece 11 secured on the section 3.

On the section 2, the profile 7 of which is concave, is embedded midway in the wood, the female part 12 of a fitting arrangement the male part 13 of which is embedded in the section 3 of convex profile 7.

When the skier exerts a stress to change his direction, the section or heel 3, by the resistance offered by the snow to lateral skidding, causes the flexible blade 5 to bend (Fig. 3) by pivoting about the spindle 8 carried by the front section 2. Abutments 14 limit the amplitude of these movements in both directions.

In said second embodiment, the surface 7 separating both sections is cylindrical but it might be conical or broken with one of the sections straddling the other.

Likewise, the fitting or guiding arrangement 12, 13 which is located in a horizontal plane, can be devised in various manners; in particular, it can be inclined or shaped in the form of a right angle.

In a constructional modification, not shown, the rear section can in its turn be divided into at least two parts connected and hinged as previously indicated concerning the front and rear sections.

In another constructional modification, not shown, the rear part of the rear section or heel can be hinged on said rear section and kinematically connected to the front section so that any relative angular displacement of the rear section with respect to the front section, causes a relative angular displacement, but in reverse direction, of the rear part relatively to the rear section.

It is obvious that the embodiments described and illustrated are only given herein by way of indication and not in a limiting sense. In a general manner, all modifications or changes which do not alter in any way the main features above set forth or the desired result, remain included in the scope of the present invention.

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HINGED SKI

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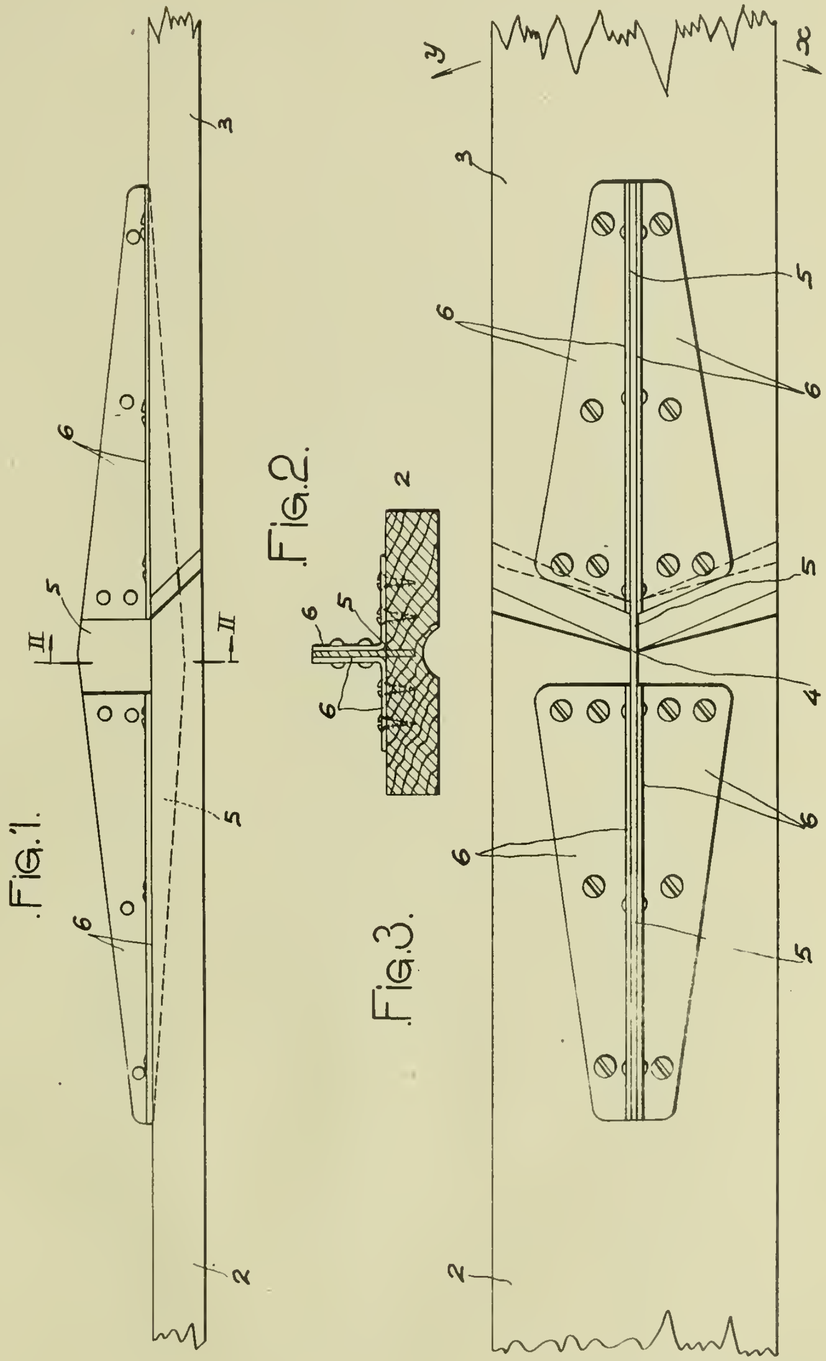

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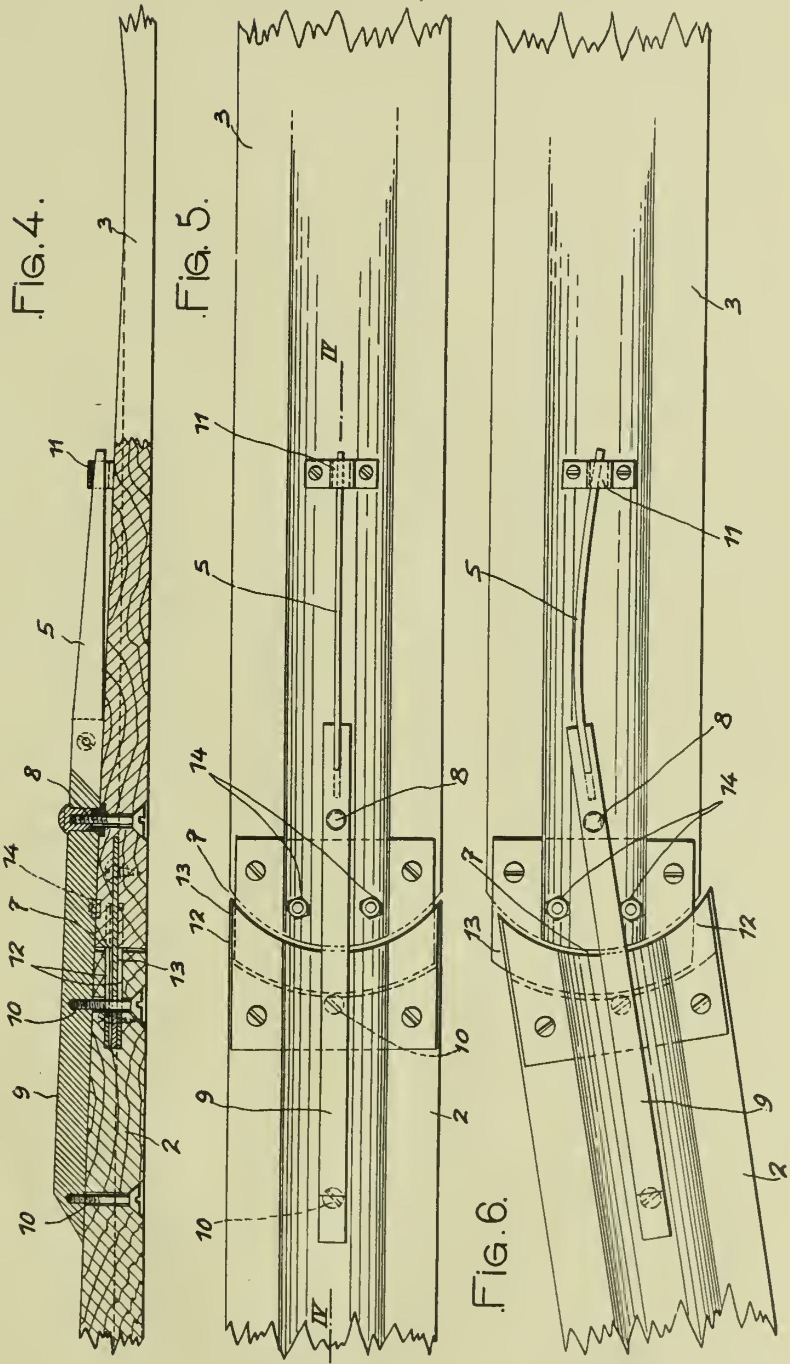

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